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Sometimes

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THE FOUNDRY

VOL. 9. DETROIT, MICH., JAN., 1897. No. 53

Some Pencil Sketches of Failures.

By HENRY HANSEN.

It is always a good point to stand in with your foreman, and if he has anything on his mind the chances are that he will tell you his troubles and illustrate them with a piece of chalk on some handy bottom board. Now, since it is supposed to be against the rules of shop etiquette to stand in with the Old Man, I want to say, that if one does right, he can not help but have the confidence of his superior. If he shows ability and merit, he will be noticed and stand in, an aim that should be better cultivated, even if it is not approved of or sanctioned by the "profession." A foreman is human, and it gives him relief to have somebody to talk to on dark days, when things in general are going wrong. My receipt for securing a stand-in is, first, to tend to my own business, and second, to make it a point when closing a mold to have things so arranged that I can say to myself, I have neglected nothing. In this way I have made more good castings than I have bad ones, and anybody can do the same thing. There is no copyright on this way of proceeding.

The trouble with most molders is that when they close a mold they are sure they will have a good casting, if that corner don't drop off, if that pocket don't cut, if that core don't blow, if that one don't raise, and if there is no crush, etc. By looking after all of these ifs before the mold is closed, the chances are very much improved for getting a respectable casting, and the maker will be in a fair way to secure the good will of his superior. It is always the poor workmen who object to the foreman displaying a show of friendship for their more able shopmates.

Nor have I sought my foreman's esteem because I had any special fondness for him as an individual. I have done so from purely mercenary motives. I have reasoned something like this, if I can make myself worth a quarter more a day, I stand a chance of getting it, and if, after that, I can make myself worth another quarter, I may get that, too; and sometimes I got it, and then again I got fired.

But on the occasion of which I am going to speak I stood in. The Old Man had got so he would nod his head and say "Henck," and I wasn't a bit backward about saluting him as "Bill." Then he would pull out his chalk and when he got through, I would borrow it and decorate another bottom board. In this way we exchanged ideas, and between us we got out whatever jobs came to the shop.

After one of these sessions, I started on the job shown in Fig. 1. What we wanted to do was to burn an addition to the neck at A, as shown by dotted lines. This neck was only one inch in diameter, so who couldn't do that; all you had to do was to pour iron in at B, let it run out at C and stop it up when enough had been poured in, and the Old Man remarked that we will take enough, twenty pounds is plenty, but we will use a hundred to make sure of it.

We poured it according to previous plans, and I went home to work out a scheme for getting my wages raised. The next morning the part that should have stayed on the casting was off, with no effect visible at A of all the metal that had been poured in. It looked like it did before and there was no sign of any union having taken place between A and B.

The Old Man stood over by the little place called his "office," scratching his head, and this is what I thought he was thinking: Here is that Henry; he gets along all right for a week or so, and then he starts to losing work again. Might have known better than to have trusted him too far. Wonder what caused that thing anyhow?

And here is what I thought: There is that Bill looking as sober as a deacon. He thought, like myself, that things were right, and now that they ain't, he acts like he knew it beforehand. If he had any better idea of doing the job, why didn't he say so;

he had plenty of chalk left, and he is foreman. Wonder what caused that thing anyhow?

It was a failure; however, an object lesson, if we could only locate the object. Before going any further, we may as well consider that iron, when fluid, has the same properties as any other fluid. We know that a stream of water, for instance, exerts a force not only according to its volume, but also in proportion to the height from which it falls. You will have observed that the stream of melted iron in passing over the spout burns away the slag that has gathered there very fast, when the cupola is first tapped and the metal moves lively. The reason the iron runs faster at this time is because it reaches a certain height inside, and the iron, as it leaves the tapping hole, has the same force as if it had fallen through a distance equal to the height of metal in the cupola.

As the iron becomes lower in the cupola, so it becomes less in force. Impurities gather at the sides of the spout, and it is no longer capable of carrying these away. The iron may possess the same temperature and yet your tapping bar is eaten away very slowly by the slow running stream, while with the fast running stream you could almost see it disappear. I am quoting this here to show that iron exerts a force not only as to its volume, but also in direct proportion to its velocity, and velocity is only another name for the force gathered in falling a certain distance through space.

A cowboy told a tenderfoot that his tobacco was good but his principles were bad, and molders occupy the same position time and again. Their intentions are good, but their practice doesn't make connection. The Old Man and myself had chalked this thing over enough to expect something better, and the reason we failed to make a good job at burning was because we were ignorant of the principles underlying this branch of our artful trade.

In pouring this, we kept the part D to be burned up full, and the metal in falling from E to B did not secure sufficient force to penetrate the liquid mass D. Whereas, the metal at A should have been kept in constant agitation and been subject to a continual renewing, we find the metal passing slowly down through D and over the surface A in such a quiet way as to utterly fail of its mission. If we had confined ourselves to keep the metal below the line F until we had thoroughly melted the part at A, and then filled it up, we should have done something and saved some hard thinking.

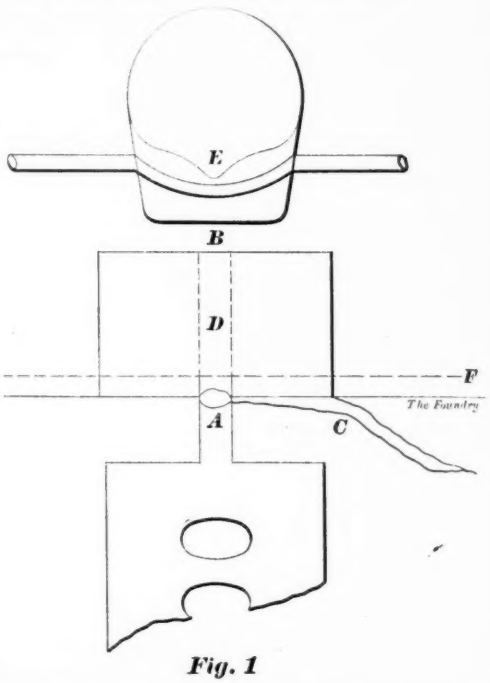


Fig. 1

The whole principle is well illustrated in burning necks on rolls, where the surface to be grafted is first cut up with the melted iron and then extensions added to complete the neck. If one should attempt to burn such a job by keeping the completed mold full, he, too, would fail, for he would deprive the metal from reaching the part to be burned with sufficient force to accomplish its purpose. Of course, ours was a small job, but it was large enough to practice on and great enough to draw attention to some laws that we can not violate without having something undesirable to gaze upon.

Seventy-five per cent of all the failures in burning are caused by a misunderstanding of the principles involved. The iron that is used is hot enough, and there is plenty of it on hand, but it is not applied right. The molders' trade is like the Chinese language, every operation being made up of different characters, and calling for separate judgment.

I fancy I can hear some of you saying: "Well, ain't that fellow going to let up?"

Gentlemen, I have the same disease as T. DeWitt Talmage, when I get started I can't stop as long as I have got anything to say. I want you to look at Figs. 2 and 3, where it is desired to burn the two parts, G and H together, the object sought being the same in both cases. In Fig. 2 the iron is poured in at I and flows out at J, traversing in its passage the channel K. In Fig. 3 the gate, L, occupies the entire length of the part to be joined together, the outflow being at M. If one unfamiliar with the subject should be asked to judge between the two methods the chances are that he would choose the one presented in Fig 2 as being best suited to the requirements. Many adopt this method because it is cleaner and looks neater. Why, they will say, you keep iron flowing through there and you can't help

Some of you will want my reason for regarding the method illustrated at Fig. 2 as a failure. As said before in this article, the action of a stream of melted iron is a great deal like the action of other fluids; they have many properties in common. Have you ever observed the flow of a stream of water? Then you have noticed that the water at the sides flows a great deal slower than the central portion. You have seen that the water at the bottom also flows slower than the uppermost part. This is due to friction and melted iron is retarded in the same manner, only more so, for in addition to the friction caused by contact with the mold there is also produced a friction by the continued tendency of the metal to adhere, caused by it losing its fluidity. In passing from I to J the hottest part of the

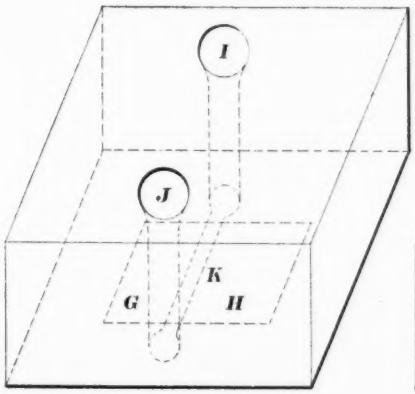


Fig. 2

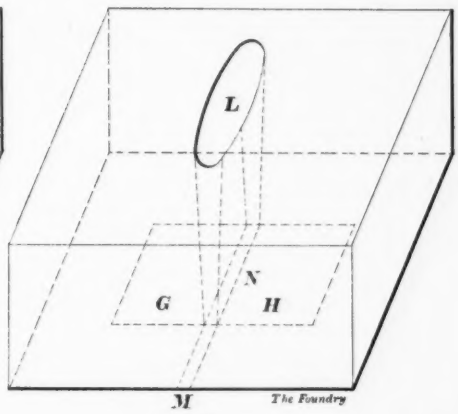


Fig. 3

but burn these pieces together, and look at the gate you got to chip off at Fig. 3, all the way across the casting, while at Fig. 2 all you got to do is to give the risers I and J a light tap and the job is done. Yes, sometimes done by the two pieces falling apart. Fig. 3 entails more work after burning than Fig. 2, but the chances for failure are less. The stream of metal can be shifted so as to strike and melt away the whole distance of the channel N, the iron is kept moving, the dull metal from the edges is washed out through M and hotter metal and with more life introduced to take its place. In this way it is utilized to its full extent, and it is surprising the work a small amount of metal will do when used directly against the surfaces to be united.

metal is continually in the central portion of the stream, and the velocity is proportionately greater here also. Thus it will be seen that the dullest metal flows over the very surface where we should have the hottest, and not only do we get the dullest metal here, but what is just as bad, where there should be the greatest velocity we find the least. This is a law that we cannot change, but we can say about it, what we do about the laws we make ourselves, there is no law that can't be got around, and the way to get around this one is to adopt a practice that will make it needless for us to consider it.

In the fourteenth century Belgium was the principal seat of the iron manufacturers of Europe.

Western Foundrymen's Association.

The regular monthly meeting of the Western Foundrymen's Association was held Wednesday evening, December 16, 1896, at the Great Northern Hotel, Chicago. In the absence of the president, Wm. Ferguson, vice-president, occupied the chair.

The secretary reported as follows:

At the last meeting I reported having written to Mr. Martin Fox asking him to express his opinion on our Apprenticeship Committee's report. I have received from him the following letter in reply:

Cincinnati, O., Nov. 3, 1896.

Western Foundrymen's Association:

I am pleased to see that your Committee on Apprenticeship has decided in their report that "a recognized apprenticeship system is not only desirable, but necessary to keep up the standard of efficiency being called for in the foundry business." It will be remembered that on a former occasion I expressed similar views before the association. That in my opinion is the salient point of the whole question. The necessity for a recognized apprenticeship system once admitted the rest is mere matter of detail upon which all parties might be expected to come to a satisfactory understanding.

I have read over carefully the recommendations relating to the subdivision of the craft and the treatment provided for each and feel called upon to congratulate the committee on the thoroughness and care with which they have treated their subject.

No objection can be raised to the classification of molders made by the committee. Molding, like all other industries, has followed the modern tendency of specialization, and the name molder nowadays conveys but a vague and indefinite idea of a man's mechanical occupation.

The age limit of 16 years is that which has been fixed upon by the molders' organization as the youngest age at which it is advisable that a boy should begin his apprenticeship, so that we agree upon that score, but I might say in passing that this limit would depend largely upon the development of the boy, and while a well-developed body is certainly a most desirable desideratum in one who intends to follow molding, it is by no means an absolute necessity, for, as is well known, the best head is not always on the broadest shoulder, and I have in my mind's eye many of our foremost mechanics, who, in physical development, are below the average; so that, while it is desirable, its lack is not of necessity a fatal objection.

Turning to a consideration of the provisions of the indenture I see little that is objectionable, and much that is certainly praiseworthy in that drawn up for class 1, the general machinery molder, and if the provisions contained more generally prevailed, they would, in a few years, raise the average skill of the American machinery molder to a standard second to none. I see but one place where I would suggest a modification and that is to change the period to be spent on the core bench from 12 to 9 months, and follow it by 3 months to be spent around the cupola. My reason for urging this is that three years is a short time to be devoted to actual molding in such a diversified field, and further that a young man in the last three months of his apprenticeship is then of most value to his employer, and is less likely to take kindly to the details of cupola practice, desirable though these may be.

And here allow me to express my strongest approval of the policy of making the apprentice to this branch of the trade put in some time on the core bench. Of late years there has been a tendency to depart from this custom and to look upon core making as something separate and distinct, in fact of the specialized subdivision of molding. As a result we have many of our younger journeymen to-day who, though equal to any so far as skill in molding is concerned, are sadly at sea when questions affecting the cores they are to use are brought forward. It is not necessary, nowadays, that a molder be as expert in the making of cores as a practical core-maker, but it is most essential that he know enough about the general principles of their construction to allow of his discussion of methods suitable alike to his necessities and the core-maker or foreman's ideas.

The cupola, too, has in nearly every instance been neglected, and the molder permitted to learn in the hard school of experience the requirements of successful cupola practice, when such knowledge becomes necessary to him. When we consider how essential good melting is to ultimate results we cannt but agree that with a more widely

diffused and intelligent knowledge of the subject, better progress would be made and many of the annoying circumstances attendant upon faulty melting would be avoided.

I feel, however, that only in the better class of foundries could we expect a complete system to be adopted, where quality of work is something more of secondary consideration. But even if its adoption be so restricted the trade would derive some benefit, in the more general demand for these higher grade mechanics as foremen or superintendents, or first hands in a shop.

Apart from this reluctance in adopting the system by employers, we have also to anticipate the objection from some of the apprentices themselves, who especially in the work about the cupola may be expected to raise some objections, and display an annoying indifference; add to this the inherent selfishness of those possessing valuable knowledge of this character when required to impart it to another and you have a combination that is no mean obstacle to be reckoned with.

The bonus system has its objections too, among them the unfair prejudices that frequently develop and the resentment thereby engendered; but still I am inclined to agree that the incentive furnished will in the majority of cases have a beneficial tendency.

In the indenture governing class 2, stove plate and agricultural implement molders, I take exception to the three-year-term of apprenticeship. The first six months might well and profitably be spent in working about the shop and cupola as suggested; the following year and a half he should work day work in making odd jobbing work, of which there is usually considerable in the ordinary stove shop, or on some of the common line of stoves, on a floor beside a day work journeyman, or under the supervision of an instructor; he would then be able to do piece work during the following two years, being gradually advanced to the best class of work as his capability merits.

It is evident the committee, in recommending the three-year-term of apprenticeship, have fallen into the very common error that because machinery molding is of such a diversified character, and is continually testing the ingenuity and mechanical ability of the molder that therefore the fundamental knowledge to be acquired is more extensive and will require a longer period of education. This is scarcely a justifiable conclusion, for when we consider the superior quality of skill required to turn out later day stove plate castings, the deftness in the handling of tools, the good judgment to be displayed in gating, etc., the neatness and despatch to be acquired in an extensive field of labor from the box stove to the complex and ornamental heater, it would seem to indicate that four years from 16 years of age will be fully occupied in acquiring the necessary instruction and experience. The difference of mechanical ability is rather that of kind than of quality.

Similar arguments would apply to the agricultural implements molder, and with greater effect because his work is more closely allied to machinery molding.

I cannot too strongly impress upon the association the necessity of putting the apprentice on day work till the third year, in fact it would not hurt if he were kept on till the fourth year. By going immediately on piece work the incentive to him is quantity for the sake of reward, quality being relegated to a place of secondary importance. This is not as it should be and accounts in no small degree for the large number of stove plate molders who are found unequal to the task of producing the class of work necessary for the best quality of ranges and heaters. The day work system removes this incentive during the most receptive period, and neatness and superior quality will be given the first place. Once acquired there is scarcely any danger of it being lost for speed will in after years readily combine.

The discount off board prices recommended when the apprentice begins under the piece system are very liberal. And now we come to the third indenture—bench and brass molding. In a consideration of this branch of the trade we are met with a somewhat peculiar set of conditions for we might fairly claim that this class could be subdivided, and if the indenture of the committee applies to those who work with a machine, or exclusively on plate or gated work, little objection could be raised, for in the majority of what we might call the specialty shops, no specified period of apprenticeship is recognized, the man being advanced in accordance with his increasing skill. But if it takes a wider range and applies to that class of bench molding which takes in general jobbing work, it is altogether inadequate. This,

I feel, will be at once appreciated by those familiar with the class of bench work referred to. The ingenuity and skill required is then of a higher character, for the molder is then something more than a mere part of an automatic machine and becomes a directing influence. A visit to any of the shops where such a class of work is made, where molders when they use them must take their own match and lay out their own job will convince the most skeptical. And when we speak of turning out a good mechanic in a certain branch of molding should it not refer to the highest grade of that class rather than to the lowest? A machine-puller, as they are usually called, who can do nothing else, scarcely merits the name of mechanic, but a first class bench molder is one and no mean mechanic at that, and in my opinion could very profitably fall in line with the other classes and make the terms of apprenticeship uniform in all branches of the trade, with the one year additional, as suggested, for those who desire to learn loam as well. Yours, etc.,

MARTIN FOX.

The following letter from P. W. Gates, president of the Gates Iron Works, is also relative to the report of the Apprenticeship Committee:

Chicago, Ill., Nov. 5, 1896.

Western Foundrymen's Association:

I read with much interest the report of your committee to your society in relation to the apprenticeship system, and I heartily indorse same. There is no matter which needs more attention than this, and it is of the utmost importance, both to the manufacturer and the foundryman, that some efficient system is adopted.

There is one suggestion which I should like to mention to you, namely, the matter of inducing the graduates of the training schools becoming apprentices, thereby becoming thoroughly practical in the trade. It is my belief that some special inducement should be held out to these young men, first, from the fact that having acquired a higher education they are capable of imbibing instruction more readily than those of less attainments. At the same time they are supposed to have had the benefit of shop work, which to a large extent gives them the fundamental ideas, and therefore relieves the foundryman of a large amount of work. It is my belief that the graduate of a manual training school, if he is graduated from the shop work in the department in which he proposes to become an apprentice, would be able to do as much in six or nine months in any event, as an ordinary apprentice would in twelve. I therefore suggest to your committee the advisability of shortening the time for such applicants.

Please allow me to suggest that from a talk which I have had with the heads of one of the manual training schools of this city, it might be advisable for your association to appoint a committee to consult with the principals of the different schools in the vicinity suggesting to them such methods as would be most likely to make such work as is done in your line, practical. I believe that all of the training schools would be glad to have a committee from your society visit them at least once a month, looking over their work and making such suggestions as the committee deems advisable.

For my own part would say that I would be glad to recommend to my company the granting of a day at proper periods, to some competent, practical man in our foundry department, to form a member of such a committee, as I believe in the future we shall have to look largely to the training schools for our workmen, and therefore it is expedient to have the work as practical as possible. Very truly yours,

P. W. GATES.

Mr. Sweeney—Mr. Gates' letter touches on a phase of the apprenticeship question that I was about to call attention to. I would like to ask what credit shall be given to the apprentice who has served a portion of his time in the manual training school or elsewhere? We are beginning to see that the manual training schools are the places from which the good assistants will be recruited in the future. Particularly we find this true in the drafting departments. A young man is taken from school and put into the drafting room and is brought along as fast as he can come. If you should take two boys, one who has been through the training school and the other who has had no experience whatever, you would naturally give the one who has been through the training school the preference. This was brought to my mind through the application of a young man from one of the training schools. He

was very frank in telling me his experience. He had gone to work in a shop in the city by arrangement with the foreman, I think, by which he was to work for a short time, six months or so, at a specified amount and then was to be brought along; but had only worked three or four days when that arrangement was annulled by a superior officer. The training schools are doing good work. I know that because I have been able to get boys from the training school that were much better than if they had no experience at all.

Mr. Ferguson—I would state in behalf of the Committee on Apprenticeship, that we canvassed this question very thoroughly before making the report—in fact we were three months or more in getting the opinions of the leading foundrymen in the country. We drew up a general letter and sent it to each of the prominent foundrymen in the country asking for their ideas. Strange to say that in all of the communications this phase was never brought up, but immediately upon Mr. Gates' mention of the matter to me I could see the force of it. I fully agree with the letter that he has sent in.

Mr. Sorge—I would move that these letters, the one from Mr. Martin Fox and the one from Mr. P. W. Gates, be referred to the Committee on Apprenticeship for consideration, and that they report at the next meeting as to the advisability of changing their report in conformance with these letters.

The motion being duly seconded was carried.

Mr. Ferguson—I would like to state that the committee is at present in a crippled condition, as we have received the resignation of one of the members. I will name Mr. Thompson to fill the vacancy caused by the resignation of Mr. Oehring.

Mr. Vrooman—I would like to say a word in regard to the point in Mr. Fox's letter in respect to putting the apprentice three months around the cupola. It appears to me that putting a boy or apprentice three months around a cupola will not give him many ideas of melting iron. The idea that seems to be conveyed by Mr. Fox and Mr. Gates is that the object of the committee in forming its apprenticeship system is to make founders instead of molders, and I have understood the cry to be that we have no good molders. I agree with Mr. Fox that there should be a universal term for all without any discrimination.

Mr. Sorge—In regard to the practice of putting a boy on the cupola for three months, my experience has been that it is a very good thing. You put a boy on the floor and make him mold and he afterwards meets a number of things in the course of his work which are to him a great deal like Greek letters. You put him on the cupola, and, although you cannot make a thorough melter of him, you give him an idea of the operations going on at the cupola, he learns to watch the process of melting and by a contact with the man who is doing the work will pick up the reason why the man will make changes in his practice. Although he will not be a competent melter, he will get a number of ideas and you can put him there in an emergency.

Mr. Frohman—I think Mr. Gates' idea is very good, if it can be carried out. The boy emanating from the technical school does not want to be a molder or a foreman, but the general superintendent of the shop. I know of two or three instances where young men have graduated that have held no other position but that of superintendent and had no practical experience. I think it is going to be a hard matter to get your apprentice from the technical schools. Another thing, a young man does not want to go into a foundry because he thinks he does not come in contact with the proper kind of people; he does not get the proper ideas; he would rather go into the machine shop, where he thinks he meets a better class of people. I spoke to Mr. Fox on this subject and he thinks in order to get good apprentices we will have to elevate the molders and the helpers.

Mr. Sorge—I would like to make a little correction. A technical school is not a manual training school. Mr. Gates speaks of the manual training school. There is a vast difference between the manual training schools and the so-called technical schools. The manual training school is supposed to give the boy a beginning in the trade, while the technical school is supposed to give him a profession.

Mr. Frohman—In the manual training school the foundry practice is the smallest part. They spend two three hours in the

other shops where they only spend a very short time in the foundry.

Mr. Sorge—Mr. Gates' idea is to push foundry work in the training schools.

Mr. Frohman—The trouble is that the foundry is neglected entirely. In the south they have more foundries in their schools than in any other place in the country.

Mr. Ferguson—I believe it is a part of the mission of the Western Foundrymen's Association to see that these things are taken care of. Mr. Gates suggests that the association become interested in the manual training schools.

Mr. Frohman—The complaint is made that foundry work is such dirty work and that the boys have to wash up before going to their studies and they do not like to do it. They only have a short time in the workshop and the rest of the time is spent in the study room. The trouble is that they do not have enough time in the former place.

Mr. Sorge—I think the Committee on Apprenticeship will go into the matter very thoroughly and consult with all the schools they can and give us the benefit of mature thought upon the subject.

The secretary then read the report of the Committee on Drying Cores after making the following statement:

I would like to state in advance that this tentative report by the committee is not final, but the committee thought it would be advisable to get this matter before the association. The whole report is subject to revision and correction later on.

REPORT OF COMMITTEE ON DRYING CORES.

The best temperature at which to dry and bake cores we have determined from a series of tests made in different ovens, and while we found quite a variation in different portions of the ovens, our final deductions lead us to believe that 350 to 400 deg. Fahr. is the best temperature at which to bake cores thoroughly. This temperature applies to all sizes of cores, as we find the only difference necessary between large and small is settled by the length of time they are left in the oven. That is to say a core 1-inch in diameter and one 12-inch diameter will bake equally well at the temperature given, only it will take the 12-inch core at least twelve times as long to bake as the 1-inch. It is our opinion that each shop could provide for itself a tabulated form, giving the length of time it would take to bake the various sizes of cores provided a stationary temperature could be obtained.

Mr. Thompson of your committee has kindly supplied us with a tabulated sheet of temperatures as taken in the core ovens of the Link-Belt Machinery Company's foundry. The oven is 18 feet long, 11 feet wide and 8 feet high, and is fired with coke at floor level in center at one end.

Temperatures in the core ovens of the Link-Belt Machinery Company's foundry:

Time.	Aug. 6.		Aug. 7.		Aug. 8.		Aug. 10.		Aug. 11.		Aug. 13.		Aug. 14.	
	Top.	Bot.	Top.	Bot.	Top.	Bot.	Top.	Bot.	Top.	Bot.	Top.	Bot.	Top.	Bot.
7 p. m.	240	150	260	150	270	150	240	110	300	220	240	180	250	180
8 p. m.	420	260	350	200	320	210	860	180	330	300	300	220	340	270
9 p. m.	420	270	360	220	320	220	390	220	360	370	320	340	350	280
10 p. m.	420	270	380	240	320	220	390	220	380	280	330	360	340	300
11 p. m.	420	270	380	240	320	220	390	220	380	380	330	390	320	300
12 p. m.	420	270	380	240	300	210	390	220	380	360	330	410	320	300
1 a. m.	400	260	350	230	300	210	370	220	360	340	320	380	300	290
2 a. m.	380	250	...	...	260	200	340	220	320	340	300	340	280	290
3 a. m.	340	240	320	210	250	180	340	200	280	330	260	300	260	290
4 a. m.	320	220	300	200	240	180	300	190	240	300	240	270	240	280
5 a. m.	280	200	300	200	220	160	270	180	210	270	200	250	220	270
7 a. m.	270	190	280	240	180	140	260	170	200	250	190	240	200	250
	Fuel used. 270 pounds.				Fuel used. 270 pounds.		Fuel used. 270 pounds.		Fuel used. 200 pounds.		Fuel used. 270 pounds.			

By referring to this table you will observe that the temperature was taken both at the top and the bottom of the oven, and for each hour from 6 p. m. to 6 a. m. for six consecutive nights. It will be noticed there is shown for the nights of August 11th and 13th, about an even temperature throughout the oven, but on all other nights the difference is quite noticeable between the top and the bottom. This, however, may be accounted for by the draft conditions on the nights mentioned, as the amount of coke used in all cases was about equal.

Mr. Thompson states that at the time he took the scheduled temperature he was baking cores that were 6 feet in diameter 9 inches thick at the center, tapering on both sides to 1½-inch at outer edge. These cores were made and dried in iron pans, and were all thoroughly dried in twelve hours' time.

We are also indebted to Mr. Stantial and Mr. Lukens, of the Illinois Malleable Iron Company, for data relative to drying cores by steam heat, and by these gentlemen we were informed that they maintained a temperature of 275 degrees and could dry a resin sand core 2 inches diameter in one hour and for small cores that seemed a very satisfactory system. Another test was made at the Gates Iron Works foundry. This oven is of peculiar design, because of its being used for drying cores from smallest to the largest and designed for shelving and side doors at back end and carriage and sliding doors at front end. The sketch of this oven shows that its dimensions are quite large for one small fire place.

It is provided with hollow walls half the height of the oven to assist in retaining heat, and it works so well that burnt cores are almost unknown in this foundry. In constructing ovens in foundries doing special lines of work, we believe it both possible and practicable to so design and build them, that a definite and uniform heat can be maintained, thus making it possible to set the time for each size core to remain in and be thoroughly baked. The conditions, however, in a general or jobbing foundry are different, owing to the various cores in use, and it is not possible to arrange matters so as to have all one size cores to dry at one time, nor is it possible to do all the drying in the day time. Hence, in foundries of this class, night usually finds the core oven filled from bottom to top with all shapes and sizes, so that even if we knew the desired length of time to dry each size, it would become necessary to leave help to handle them from the oven as they became dried. Whether this would prove profitable would have to be proved by each individual foundry.

WM. FERGUSON, Chairman.

MR. PETTIGREW'S REPORT.

The question of the best temperature at which cores should be baked or dried is one which each foundry ought to be able to decide for itself. The work in each separate foundry is so different in details, there can be no hard and fast lines laid down for all.

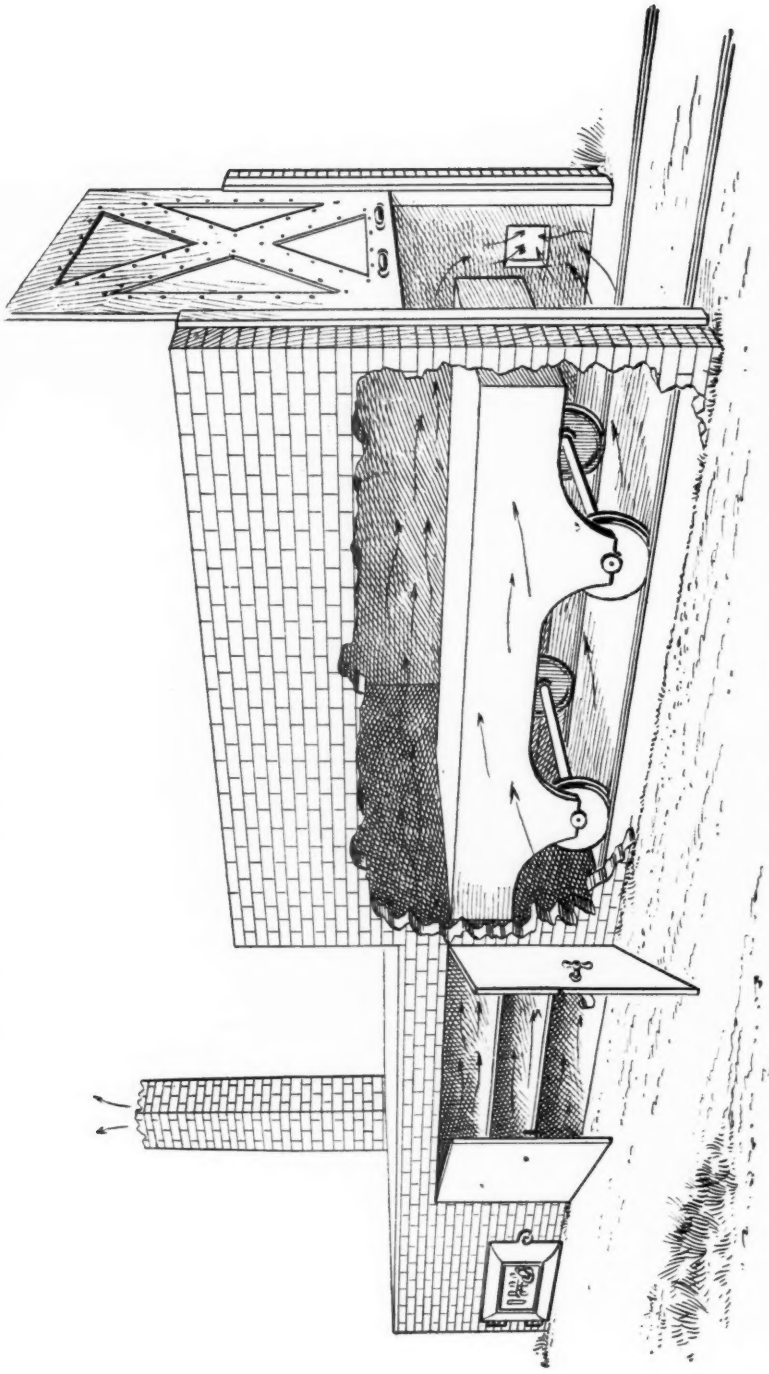
In a regular jobbing shop, the cores may cover a lot of pipe cores, cylinder cores from body cores to port cores, that will have to go into the oven with dry sand molds that have to be dried for next day's work and all expected to come out just right.

There is so much coal dumped near the fire door of oven, which the watchman or other employe is expected to put into the fire place during the night and which experience has shown will generally do the drying required, but if there are any extra large cores or molds, it will be found the small ones are dried and perhaps burned, but the larger ones are not dried enough to be used that day and may need another night's firing, which may burn them or not according to the time and ability of the men in charge or the material of which they are made.

In drying molds without any flour in the sand mixture, I have found that a temperature of 400 degrees continued from twelve to fourteen hours will generally drive all the moisture out, but where there are cores in the same oven with one part flour to ten or twelve parts of sand, the cores will be all burned and not fit to handle.

In this western country the general run of foundries have only green sand work with comparatively small cores. The ovens are, as a rule, small, and from a couple of riddles of scrap cuttings from the carpenter shop to 1,000 pounds of coal or refuse coke that is too small for cupola we will furnish all the heat required, but it will be found that nearly 500 degrees of heat will be required from four to six hours to thoroughly bake cores as generally made with a mixture of sand and flour from the small cores generally used to those of about 12 inches diameter. We have seen cores dried successfully in a steam heated room with a temperature of 240 degrees, where there was no danger of burning, and think that where exhaust steam could be used advantageously much fuel could be saved in most foundries, especially where a large amount of small cores are used constantly.

The drying of cores, like every other thing in a manufacturing concern, to be successful, needs care and attention, something which it seldom gets. Therefore I think that the waste heat which goes up the smoke stack from a boiler or from the exhaust of an



CORE OVEN IN USE AT THE GATES IRON WORKS.

engine, could be used successfully with proper care and attention, and with proper appliances could be used with great economy in foundry practice.

JOHN PETTIGREW.

Mr. Thompson—The table is not correct because we had two different pyrometers which when cool did not register alike, and the supposition was that by deducing the difference we would get the exact temperature of the oven. That seemed to hold good for the first five days of the experiments, from the fact that they registered so nearly alike with the same amount of fuel. But on changing the pyrometers it was found that the heat was greatest in the lower part of the oven, which I think should not be. I cannot account for the differences except that the pyrometers are not correct. I understood that if a pyrometer registered 200 degrees at the start and went up to 400 degrees it registered 200 degrees of heat. It is evidently not so.

Mr. Ferguson—Even if the report is not right, in order to prove that it is not right other people will have to go through the same experiments that the committee have, and we will get their data and bring out more knowledge on the subject of temperature. The first thing that struck me was that the relative temperatures were about the same at all times. It shows that the thing was not working very far out of the way.

It was moved and carried that the committee be continued and that the secretary be instructed to send out for the committee letters to members of the association requesting them to make experiments on this subject and report to the committee.

Mr. Johnston—I do not suppose it matters much what kind of fuel is used, but it might be interesting to get a report from foundrymen using oil and gas, as it would broaden the subject a little. Go down in the oil and gas regions and see what they have to say.

Mr. Sorge—It seems to me that you are broadening the scope too much, and getting into things that are of a different character. The question of fuel is not involved in temperature. If that is to be gone into I think it should be gone into separately. The meeting then adjourned.

A Criticism on Thos. D. West's American Foundry Practice.

By ROBERT G. MOORE.

There is an old saying that it takes everybody to know everything. Mr. West's book is valuable and full of real information. For instance, on page 245, treating of green sand scabbing, he says, in italics, "There must be a bubble before there can be a scab." This proves him to be a rare observer. I made that discovery when an apprentice, but in sixty years of foundry life have failed to find one molder who had reached the same conclusion. Foundry life presents too much complication for any one person to really understand it all. The following are what I consider a few errors in T. D. West's book: The last paragraph on page 43, where he says: "Keep your feeding heads and risers air tight." It has always occurred to me that this depended more or less upon how well the mold had been made. With a perfect mold, I think the covering of risers is superfluous. The last paragraph on page 56, wherein occurs the following sentence: "Light work should be vented to the surface of the mold, so as to allow the air to escape rapidly." I am convinced that air does not stop the flow of iron; if anything exerts a retarding influence it is steam. Bottom of page 57 and all of 58, wherein he treats of venting green sand molds, the outlets for vent and the explosions that sometimes occur, gives a mixture of both theory and practice. It is better practice not to light such vent pipes, to avoid explosions, until all the atmosphere has been driven out by the gas, when it becomes safe from explosions. The pipes should be smothered with, say a bunch of wet hay or piece of carpet. The two first lines on page 101, stating that all melted iron contains more or less dirt, is a statement that is certainly debatable. The dross accumulating on melted iron, in a clean ladle, is purely oxide of iron, made by the union of iron with the atmosphere on the surface, and does not come from below. A 100 pound ladle of iron, kept melting in the atmosphere would be all converted into oxide in a few hours. On page 102 and 103 is shown the plan of a skim gate applied to a crank which will make a clean casting, but is too extravagant in melted iron, the loss being at least 5½ per

cent at every melting, and causes a certain amount of coke to be consumed. This loss is not heavy, but unnecessary. The waste lies in two superfluous gates to fill, a pouring basin, and possibly an overflow. The writer has cast many polished cranks for automatic engines up to 1,000 pounds weight with only a common 1¾ inch pouring gate, passing the iron through two whirling blocks, or chambers, about four inches in diameter and two inches deep; and a six-inch feed gate completed the set. On page 112, in the last paragraph, the momentum force of the fluid iron against the cope is greatly overestimated. Very rapid pouring of thin plates with entirely insufficient risers, a very common fault, is a very dangerous combination. The blow given by the stream falling into a small gate may be equal to many inches of rise of gate, giving the appearance of being the result of a sudden blow, in lifting the cope. On page 246, last paragraph, the buckles in loam scabbing is partly attributed to steam, as in green sand scabbing, which is doubtless a wrong theory. It is caused entirely by stretching under the heat. My experience suggests that no loam mold was ever made and dried well enough to stand much delay in getting on the pressure required to hold the loam to the wall. I have ample proof on this point. Does not one of the chief virtues of sawdust, chaff, etc., lie in its loosening effect, and is not a mold where they are used likely to "give" more easily? Page 291 gives us a wrong impression, if I understand the subject. Cast iron at every melting gets both harder and stronger, but loses elasticity, a high mercantile quality. To illustrate, a glass chain will sustain a heavy load, and yet a link may be knocked out with a penknife, owing to its low elasticity, not strength. The statement is also made that gray iron melts easier than white cast iron, which is certainly a mistake. There is a law, understood to hold true with all metals, namely, that all alloys of two or more metals melt at a lower temperature than the original metals, as white iron is an alloy of iron and combined carbon, it should melt easier than gray iron with carbon mechanically mixed. It may be proper to remark incidentally that Mr. West's citadel has not been fully demolished, but stands erect, capable of resisting many such assaults. The war spirit back of this criticism is the desire to call out different views on debatable questions, and not to in any way unfairly criticize Mr. West's splendid work as a thinker and writer on foundry subjects.

Reduction of Iron by Electricity.

A German contemporary gives an illustration of a large electric furnace which has been constructed for experimenting in the reduction of iron ores. It is said to have succeeded well in the production of very pure iron, but no furnace large enough for the action to be continuous has yet been built, and we think the reason is obvious enough. Five hundred horse-power produced only 220 pounds of pure iron in 20 hours. That may be a splendid result for an experiment, but it can hardly be said to give high hopes of an economical production ever being developed by this process.

No other iron range so far discovered possesses greater apparent reserves than the Mesabi of Minnesota. Conservative estimates formulated from the records of properties now exploited and worked, together with others determined by systematic explorations and anlyses, show that the Mesabi range can supply ore (which will equal in average iron and phosphorus contents) double the quantity which the entire Lake Superior region has produced in fifty years. This means 200,000,000 gross tons. In this estimate there are not included a number of properties which have been imperfectly explored.—John Birkinbine, mining expert.

One of the handsomest books that has come under our notice is the General Catalogue of the Buffalo Forge Co., Buffalo, N. Y. Although classed as a catalogue, it contains such a vast amount of data relative to air handling apparatus, that it is in reality a valuable handbook for engineers and architects. The facts and figures embodied therein are derived from actual installations of the various apparatus to which they relate, and are not to be compared in value with the theoretical calculations commonly published.

J. A. Fay & Co., Cincinnati, have issued a handsome catalogue of Carving and Edge Molding Cutters.

A TECHNICAL JOURNAL DEVOTED TO FOUNDRY INTERESTS.

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THE FOUNDRY is issued promptly on the 20th. of each month, and will spare no endeavor to furnish valuable news and information to those interested professionally or incidentally in molding, melting, mixing of metals, foundry management, etc. Persons connected with any of these lines of industry will confer a favor upon the Editor of this Journal by sending him news from their section of the country pertaining to the foundry interests, particularly individual theories and experiences of practical value.

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Trade Outlook.

Business is done only by those who hustle for it. The work does not so far seek the man. A great number of foundries have started up during the second week of the new year with increased working time and, in some cases, with an addition of hands, though there is no concerted action upon the part of foundries to "get agoing."

The fact remains that a certain number of shops are either situated unfavorable for shipping facilities, or have allowed their works to remain so stationary in point of equipment, that they find themselves unable to meet competition at a profit in these days of close margins. The shops with the most approved appliances and system of details for turning out work are invariably found to be the ones that are transacting a fairly large volume of business.

The past year has witnessed a general weeding out of weak concerns. These were principally such as entered the trade during flush times, who thought that anybody could conduct a foundry, and were, in the main, unacquainted with the business in its detail. As an object lesson, their demise is worth considerable.

What amounts practically to a consolidation between the Rockefeller and Carnegie interests, with a complete system of transportation from the Mesaba range to Pittsburg, has caused some uneasiness about future prices of iron and steel. It is generally conceded that the low cost of production, to which these giant organizations have brought the mining and carrying of iron ore, will ultimately result in a slightly lower price for pig iron.

Those that expect high prices to indicate a return of prosperity, are doomed to disappointment, because there are so many who are able to fill contracts at present prices, and make a profit. Lower values have come to stay in other industries through the installation of more productive appliances, and the foundry will be forced to travel the same course.

The workshops of the world are passing through a continual state of transformation, and those that are at the head of the procession are the ones who are doing the most business.

Should the Blame be Placed on the Material or the Men Who Make it.

Another item has started on a globe-trotting tour through the mechanical press. It seems that a firm had been using cast iron pipe as a steam main for a number of years, during which time some of the sections had failed, and was ultimately replaced with wrought iron pipe. Some time later a column was wanted and one of the discarded pipes was put in the lathe to be cut off to the right length, when the discovery was made that it was 1¼" thick on one side and only ¼" on the other. After describing how pipe is made, the conclusion is drawn that cast iron should not be used for steam pipe, or in any other place where it is exposed to a tensile stress, as the uncertainty in its behavior is not to be trusted under tension.

We fail to see anything extraordinary in this, or anything discreditable to cast iron. The fact that ¼" of it withstood a pressure of 75 pounds for fourteen years, we think is pretty good testimony to its "uncertainty." We have no excuses to offer for the unequal thickness of metal found in this case, or in any other foundry work. There are foundries who will turn out inferior work just as there are machine shops, but one can secure a perfect product in both places by insisting thereon. We can see no more reason to condemn cast iron pipe because a number are found imperfect than we can to advise the discontinuance of steel pipes for defects these may show. With a proper inspection in the first place, these pipes would not have been accepted, and it seems to us that anyone who cared to look would be able to distinguish a flaw so prominent as this difference in thickness. Instead of being a discredit to cast iron, it is a reproach to those who accepted it.

The Cost of Armor.

Secretary Herbert, in the early part of the month, made a report to Congress relating to armor plate and its cost. As armor plate is merely a form of iron, it is interesting to note the price at which it is sold and the extent to which the cost of labor increases the price of a very cheap commodity.

Mr. Herbert reaches the conclusion that the cost of material and labor per ton is $198.70, but to this the companies engaged in producing armor take a wide exception. President Linderman, of the Bethlehem Iron Company, places his estimate for labor and material at $250, interest on cost of plant $78.29, maintenance and depreciation $132.72, working capital $33.55 or a total cost per ton of $494.56.

The Carnegie Company declined to give a full statement of costs, but gave the elements, entering into it exclusive of shop cost. This foots up to $224.96 per ton.

If the secretary is anywhere near right, and to sustain his figures, he mentions the Bethlehem Company as furnishing the Russian government with armor for $249.00 per ton, these companies are making a "drug store profit" on their investment. The cost of the two plants is estimated at $1,500,000, though this can not be said to be a large sum in these days of large manufactories, in fact, the combined cost of both plants is not as large as that of several rather small steel companies in different parts of the country. What strikes one with the greatest force is the amount calculated to cover maintenance and depreciation $132.72 for one, and $143.43 for the other. This would allow a complete renewal of the plants in less than five years, besides returning over 12 per cent on the investment as allowed for elsewhere.

Evidently some of our foundrymen can do closer figuring than this, and still manage to pay their insurance. Competition would help to reduce the cost of armor plate. We have said enough to show that there is money in the iron business, if we only get into the right kind. The kind that will allow us to credit $78.29 per ton of output to interest on plant.

There is no Danger.

It will undoubtedly be a surprise for many of our readers to hear that some foundrymen have formed a trust. It is such a common sight to see one engaged in pulling the other down, and the price of castings with them, that the idea of forming a combination will be generally doubted. Yet half a dozen manufacturers of cast iron pipe have been cited to appear before the courts at Chattanooga, Tenn., to answer such a charge.

For some time the cast iron pipe business has been regarded as being subject to the fiercest kind of competition ever known in

any branch of the foundry trade. It is not very long ago that these same people were credited with selling pipe below cost, yes, we recollect one instance where it was claimed to have been sold for less than an equal weight of pig iron was worth at that time in the open market. During this period, when wages was being reduced to keep pace with the low selling price, the suggestion was heard on all sides why don't they stop their ruinous competition, fix a fair price for their output, and give those connected with it a chance to live?

It is yet undecided whether this suggestion was acted upon or not but a cry of monopoly, trust and whatever choice epithets come from populistic tendencies went up when the city of St. Louis could find no one to bid lower than $24 per ton for pipe wanted. We are not in a position to say as to whether this price is exorbitant or not, we only know that the majority of pipe foundries had worked for the benefit of the public a long while, and if they got together for the purpose of raising enough money to repair their plants, we can only account for it, as being done in self-defence, in the interest of self-preservance.

The public is altogether too easily swayed by the cry of trusts raised by some sensational newspapers or politicians of the same color, who would readily consent to keep their jaws closed upon the payment of a proper silence fee. The public forgets that reckless and ruinous competition is harmful to a community as well as to individuals. None of us are any help to sustain society, unless we are engaged in something that pays a profit.

Seriously we fail to see the possibility of half a dozen concerns controlling the price of pipe when there are a large number of others with a surplus at hand and plenty of material and labor ready to turn out more. Whenever the time comes that there shall appear evidence of being a profit in casting pipe, plenty of capital will be found ready to embark in such enterprises and this has always nearly succeeded in crippling any combination that attempted to take to itself more than its just share of advantages.

Handicaps to Success.

There is nothing out of the ordinary in the foreclosure of the West Superior Iron & Steel Co., under a mortgage of $1,600,000, but the statement, that though encumbered by such a large mortgage, the entire plant could be duplicated to-day for about $600,000. While values may to some extent have depreciated, this does not account for so large a deterioration in value, and we can only infer that this plant has been capitalized beyond what was actually invested in the necessary equipment. It is one fault with large manufacturing enterprises to float more bonds than are actually needed to carry on operations, and then attempt to earn dividends on capital that never entered into or helped increase the earning capacity of the plant.

Of a similar nature to handicapping an industry with watered stock is the attempt so often seen of establishments expecting to make a good showing with out-of-date appliances. A number of railroads are side-tracking thousands of dollars' worth of steam motive power, not because it is worn out, but because a cheaper power has been found. We know of a large number of machine shops that have discarded a great number of machines which had only been in use a very short time. These machines were not worn out, not by any means. They were, in most instances, as perfect as on the day they were installed; but something better had made its appearance, something had come that was capable of producing work at less cost. To have retained the old machines would have had the same effect as carrying on a plant with the heavy load of over-capitalization.

How many of our foundries are suffering from carrying the heavy load of an overcapitalized stock of old tools? In how many instances would it prove a profitable venture to level them with the ground and make a fresh start? In how many are they waiting for present equipment to wear out before entering upon such a rearrangement as the present time calls for?

There is such a thing as making appliances last too long. Long life of some has been the death warrant of many a business. A thing is only economical so long as it performs the same amount of work with the same outlay as any other. When it ceases to do this, it is well to dispose of it to those who hanker after bargains in second-hand tools, or, failing in this, to give it away. It is money gained in the end.

Ought We Adopt the Metric System?

In another column one of our English correspondents suggests the adoption of the metric system in connection with a standard system of tests. It should be borne in mind that no change should be advocated that does not carry with it an improvement over existing conditions. It is a question whether the adoption of the metric system would confer any benefit upon us that we do not now have. It certainly would result in a great deal of temporary annoyance, for, as no one can think in a foreign language, neither can he calculate in foreign figures without a great deal of practice. As the English speaking nations form by far the majority of those who are interested in the production of iron and steel, it is doubtful if individual practice could be made to yield to such an innovation. It may be interesting to note some of the points made by Mr. George W. Colles in a paper on "The Metric vs. the Duo-decimal System," which he read before a recent meeting of the American Society of Mechanical Engineers, from which we take these deductions:

"That the assertion that the people ever agitated for a change of system, besides being baseless, is irrational; because the masses of no country or race can appreciate the differences between systems; they use what they always have used, nor do they see any reason for doing otherwise, or why they should require a law to enable them to do so.

That we see no signs of the prospective universality of the metric system; that, on the contrary, the metric units seldom or never find their way into use in non-metric countries, while, on the other hand, the English inch is the virtual standard of Europe, having fought its way against every kind of obstruction; and, in addition, Great Britain, when she has taken a step, has always gone in the other direction.

That, waiving all these objections, abstract advantages must counterbalance the enormous difficulties of a change, in order to imply the propriety of such a step; and that we should not be justified in taking it without the well-decided concurrence of a majority of our people.

That the opinion of practical men generally, and of engineers in particular, approves the metric system per se only in a few cases, and almost invariably deprecates compulsion.

That the legal and political difficulties of such a step are enormous; that it is extremely doubtful whether congress has either the constitutional authority or the executive power to enforce it; that no amount of legislation can change the laws of nature.

That a radical change in the weights and measures of a nation, and particularly our nation, is, in fine, utterly impossible, and beyond reason."

A Foreman's View.

A foreman molder, in a letter to "The Mechanical World" (Manchester, Eng.), gives utterance to the following:

"We, as foremen, have different views and ways of handling men to get a good day's work out of them for a fair day's pay, and we are puzzled at times to get out the work at a reasonable cost. When I give a molder a job, I give him the model or pattern. I give him full particulars how to mold it, what sand to use, how to run it or cut his gates, the size of the dish, and the height of his runner-box. Then I take the risk, as I look round and keep a strict eye on each molder to see that he does his work well, and that he is not spending too much time on one job. * * * To become a practical iron-molder a man must have several changes in different foundries.

"I feel sure the readers of "The Mechanical World" will agree with me that when a molder has been in one shop twenty years he knows all the models and almost every hole and corner. But come to change shops, and he may be at a great loss as to how to mold different patterns. Then he has to put his wits to work, and unless the foreman gives him a helping hand he is at a loss as to how to proceed to secure a good mold that will stand the pressure of metal so that the casting may be free from blowholes, scales, swells, etc. A molder must have a lot of experience. There are hundreds of good molders who are discharged on account of bad castings."

It is an old adage "that too much and too little spoils everything." This holds good, too, when it comes to giving advice. Most foremen dispense more of this than is needed. They seem to think that it is their duty to continually explain how to do it, and unconsciously they sometimes tell us how not to do it.

Advice is needed everywhere, but it should only be given when needed. Make a distinction here, and don't compel those with whom you come in contact to swallow your advice unless they need it.

We have never known a molder or other mechanic yet, who had any ambition about him, that did not always prefer to do a portion of the thinking and planning to be done for himself. Tell a molder just what he has got to do from start to finish, and you deprive him of the satisfaction he derives from being in part allowed to solve his own problems.

And what makes good workmen? What turns them out better than to give them the most difficult work and let them do some thinking? As individual character is seldom developed without a generous amount of contact with opposition, so is individual ability never created until a demand is made for that ability. Take away a molder's chance to think, and he will lean on you forever. Make him exercise all of his faculties, and you give him the best apprenticeship in the land. He may lose work once in a while, but he would do the same if he followed your instructions explicitly throughout.

There are but few foremen who enjoy the presence of the molder who is forever asking questions. He is a nuisance, who likely never learned the A B C of his trade, because he served his time under another nuisance, the foreman who wouldn't let you set a gagger, unless he had told you which way to turn it.

We have the highest regard for the advice that is asked for and given in its proper place, but we hold, at the same time, that no more degenerating influence can be turned into a shop than an indiscriminate scattering of thoughtless advice.

As for keeping a strict eye on each molder, we think our British cousin would get along better if he adopted the plan of having the men keep at their work without being watched. While you are watching one man, the rest of them are watching you. It is only a matter of principle to have men do right, without a strict surveilance. Reward every man according to his worth and you have the key that causes him to work as diligently without your supervision as with it.

While changing shops improves molders, it is not so much the difference in practice that causes this, as the increase in confidence that settles on one who is turned from one thing to another. Confidence, however, never comes to those who are brought up under an overdose of advice. Confidence only results from the security one feels in his own stability after successfully overcoming obstacles by personal application.

As for good molders being discharged for making bad castings, Brother Jonathan, our experience differs. On this side of the water we have never known a good molder to be discharged for this cause. All GOOD molders here make good castings.

Krank's Korner.

It is always the cope that nobody looks under that drops out.

* * *

If you are badly in need of a casting, keep it to yourself, otherwise the chances are that you will get it bad.

* * *

Your men may be supposed to start to work by your whistle, but we notice that they generally stop when your neighbors give the signal.

* * *

A writer advocates the use of stationary beds for open sand work, built up with permanent straight edges, preferable of iron, and prepared in a more lasting way than is generally in vogue. This should be a good plan to follow for shops which do this class of work, and have the room to spare. The greatest cost of open sand molding is always the waste of time incurred in finding level, straight edges, and getting these in their proper place. Besides, such temporary affairs have a knack of getting out of true while being prepared, and have to be gone over several times to be sure that they are straight. A permanent bed should be made of such dimensions as to take in any work likely to be wanted, and, if very large, should be provided with a well-made cinder bed to avoid the labor of cross venting that is usually done in such cases. With such an arrangement the production of open sand work would be greatly facilitated, and the annoyances resulting from hastily prepared beds entirely obviated.

Machinery vs. Brains.

The skilled workman of to-day is as much a product of the times as the machines he is so largely occupied in tending, and though the operative of to-day may be individually as intelligent, and undoubtedly far better educated, and an all around better citizen than his predecessor of a previous generation, yet, so far as his actual work is concerned, brain power is being practically superceded by steam power. I make this rather sweeping statement deliberately and with a sincere conviction that, disguise it how we may, while our machines are becoming almost human, nay, almost superhuman in their powers, the workman himself is, as a matter of fact, more and more nearly approximating to the condition of an automaton—a wage earning machine. He is living upon the brains of dead and gone inventors, pioneers of mechanical industry, like Maudsley and Bramah and Whitworth. The mechanic of the present day gets through his day's work without the necessity of exerting himself to more than the most trifling extent, either bodily or mentally. I quite admit that this is a gain, on the whole, for all the parties concerned; for the workman, because, though his work is lightened, he earns better wages, and is at liberty to devote his intelligence to doing good for himself in other ways—his status is raised; he has time and opportunity for rest and rational recreation; his day's work is not, as formerly, his day's sole occupation. It is a gain, too, for his employer. A single man's production is now from five to fifty times what it was in the early days of mechanical engineering. It is good for the community at large—directly, because the increased facility of production lessens the price at which good articles may be purchased, and, indirectly, because the man, relieved from exhausting toil, is a more valuable citizen than he who has no leisure to devote to the improvement of himself and his fellows. I must not, therefore, be understood as conveying a reproach when I assert that the mechanic of the period has his mental as well as his bodily labor performed for him.—W. D. Wansbrough, in Cassier's Magazine.

We always thought that machinery never could displace brains. We have also been led to believe that the more work machines were made capable of performing, the more work was created which they could not do, and that wherever machinery displaced man it forced him into better fields, where he was compelled to use his brains. We had rather supposed that instead of living on the brains of "dead and gone inventors" we were living as a result of our own exertions, bodily and mentally, principally the latter, which machinery has never been able to do for us. As for the mechanic of the present day getting through his day's work without the necessity of exerting himself to more than the most trifling extent, either bodily or mentally, we would like to take the writer to any foundry in the land, and if the mechanics there don't exert themselves to more than a trifling extent, bodily or mentally, and in most cases both, we will throw up our present job and apply for a situation, even if we have to make sash weights. We will leave the reader to judge whether he uses his muscle and his head less than he formerly did. Personally, we have been compelled to increase the output of both during the past decade, and what holds good in our trade also undoubtedly applies to others.

There is no piece of mechanism so complete, that intelligence and brains can not perceptibly increase its efficience.

It Is Doing Well.

The secretary of the Western Foundrymen's Association has sent us an artistically gotten up certificate of membership. As a power for good, no society excels the Western Foundrymen's Association, and we predict for it, an extending influence in the future.

Is He Safe?

The Anderson, Ind., Herald describes the way W. A. Wolley is going to protect his foundry against fire. By a system of pipes, that respond to the influence of heat and spring a leak, it is said, that the building can quickly be flooded. What we would like to know is, how Mr. Wolley manages to flood his roof, where nearly all foundry fires start or do the greatest damage, while the floors generally escape intact.

A description of the making and laying of an Atlantic cable, with pictures illustrating all the interesting points, will be a feature of McClure's Magazine for January.

Pokey's Pointers.

Old Nick stalked into Pokey's the other afternoon and saluted the old man with:

"I have just learned something. Hello," he continued, "is that the last FOUNDRY? Those people blowed themselves this time, didn't they? I will just look through it to see if anybody is dead that I know."

That is Old Nick all the way through. He doesn't believe in subscribing for any kind of a paper, because all he cares about is when somebody dies that he knows. Meanwhile he is looking for the Obituary, he manages to get acquainted with the balance of the contents. When he has finished reading it, he will hand it back with the remark: "There ain't nothing in there to amount to anything."

This is intended to pay for his use of the paper, and meant to convey the impression that since he has received no benefit, he can not possibly be in your debt.

There is an Old Nick in most every town. When he has read your paper he wants to use your telephone, and the chances are that when he hangs it up he will say: "That phone is no good; can't hardly hear through it." He has had the use of it gratis, but it won't do to speak well of it, otherwise you might expect him to pay for the privilege.

He will come over and borrow your flasks, and when he returns them with the bars burned out, he will tell you that he had a devil of a time to keep the sand in them. This is said to let you know that he really lost money by using your tools, in which event you are not supposed to charge him anything for the favor.

When you are nearly through with your heat, here come a couple of Nick's men with a bull ladle, who want to get just a hundred pounds of iron to appease an irate customer, who threatens to change Nick's face into a map of the moon for continual disappointments. He is lost unless you help him out, because he will not get his own blast on till about nine o'clock p. m. You let him have the iron and send your cupola tender up to throw in a little more. You do all of these things, and what thanks do you get for it?

Old Nick wouldn't have got his shop painted if it hadn't been for the Hoods down east. We would naturally expect him to be prosperous, because he is forever sponging one thing or another from his neighbors, but we have yet to hear of the first case where anyone has gained anything financially or otherwise by making a nuisance of himself. Such a man tries to get through the world on passes, and he will only desist when a certain personage passes him along to a place that is hotter than a pig bed.

"So you learned something, Nick?" inquired Pokey.

"You are blamed right. I have just found out how to make strong castings," said Nick, as he swelled himself out as men will when they imagine that a great share of the world is dependent on them.

Just them Tom appeared, and Nick gave an uneasy start, as he thought of former contacts with this individual. Pokey motioned him over, and then invited Nick to go ahead with his narrative.

"You see, it was like this," began Nick, addressing Pokey; "the other day a gentleman comes in, and, says he: Mr. Yahoo, how are your mixtures? Do you want to make stronger castings? Of course I did, and what do you think? He made them."

"How did he do it?" asked Tom.

"Well, the whole business is something I haven't got down to; but he made them."

"I thought you learned something, Nick?" interrupted Pokey.

"So I did; I seen him make them."

"There is a difference between seeing and learning," suggested Tom. "Did you pay for the experiment?"

"I should say I did."

"If you can't tell how he made your castings stronger, may be I can."

"Was he over here, too? He said he would only let his mixture be made in one shop here," asked Nick eagerly.

"I haven't seen the man," answered Tom. "But I can duplicate his castings. In the first place, he insisted on you buying a certain amount of steel scrap, or something he called that anyhow."

"Correct," said Nick.

"He didn't spare your coke pile, but melted his mixture very hot."

"That is what he did."

"Before you tapped out he stepped up to the ladle and threw a small paper in there, which burned up with a bright flame, when the metal reached the ladle. You were about to cross yourself at what you thought was his mysterious power."

"You have been talking to some of my men. I know you have, or else you are a mind reader," said Nick excitedly.

"Haven't seen your men, and don't know what you have got on your mind. How do you know that your castings are stronger?"

"They look like it, and work like it, although I don't know for sure," answered Nick.

"Looks ain't a very good thing to judge by, but if you want some more castings of the same kind, don't pay any more royalty for the privilege. Use the same amount of each material that he did and you have the same quality of castings."

"But, Tom, I don't know what he had in those papers."

"Never mind the papers, Nick; that is what you paid for, although it had nothing to do with the castings. That is a kind of a wand that these magical metalurgists have and use to mystify their patrons. You make me think of an old French Canadian who once gave me a pointer. The firm he was working for undertook to make some chilled car wheels, and then found out that their iron refused to chill."

"I know how that is," said Nick. "Once I undertook to make a couple of hundred wheels, guaranteed half an inch chill, no more or no less. If I hadn't thrown the contract up it would have thrown me. I lost money as it was, and backslid from the First M. E. Church that fall."

"I ain't got any reference to you, Nick; so you needn't think you can tell this story," interrupted Tom. "This firm didn't throw it up, had better luck, and luck it was in their case, though many people will insist that there is no such thing as luck about a foundry. They changed pig iron and coke, still no chill. No, no patent iron man with more brains than you have, came around. That was before the green goods man and his secret mixture got as far as the foundry. The fool-killer was around in those days, and people that would have patronized a cast iron bunco game would have suddenly disappeared. The old French-Canadian saved the firm, at least that is what he said, and I always believe in giving a man credit for what he claims to have done until I have proof to the contrary. After all the receipts for chilling mixtures that could be begged, borrowed and stolen had been tried, and in vain, the old fellow suggested that they try to see how it would do to employ some old burnt-out grate bars laying out in the yard, that had accumulated for years and been voted useless. Result, a little chill. More grate bars, more chill, until they by a little experimenting, procured a satisfactory chilling mixtures. Do you see the point, Nick?"

"You bet."

"I am betting the other way. What did those rotten grate bars do?"

"Made the iron chill."

"Yes; I told you that much, but by what action did they do so?"

"Now you have me; how am I supposed to know? I am no sorcerer."

"But still you believe that there is sorcery connected with some of the mixtures that are turned out." You are like the man who suggested to use the burnt grate bars. He insists that good car wheels can not be made without old grate bars. Don't you know that all that is needed to obtain iron of different qualities is to change the elements entering its composition. The old grate bars effected a reduction in graphitic carbon and silicon, a too high percentage of which was the main reason why the iron refused to chill. By reducing or increasing certain elements you can also make your iron stronger, if strength is what you are after."

"But how am I to know which way to go, Tom?"

"That is what you want to learn and figure out for yourself. When you pick up a paper, don't look for somebody that is dead; pick out something that is alive, spend a few dollars for information in a practical way. The reason we have so many men in our trade who know but little, is because they expect somebody to force an education on them gratis. This may be a free country, but they are not dealing out education like they are vaccination, not by a darned sight. If you want to be well informed in your own business you have got to pay for it in one way or another."

The Rhode Island Tool Co., of Providence, R. I., have placed the contract for their new galvanizing room with the Berlin Iron Bridge Co., of East Berlin, Conn. The building will be a fireproof structure throughout, no woodwork being used.

The Foundry Department of Girard College.

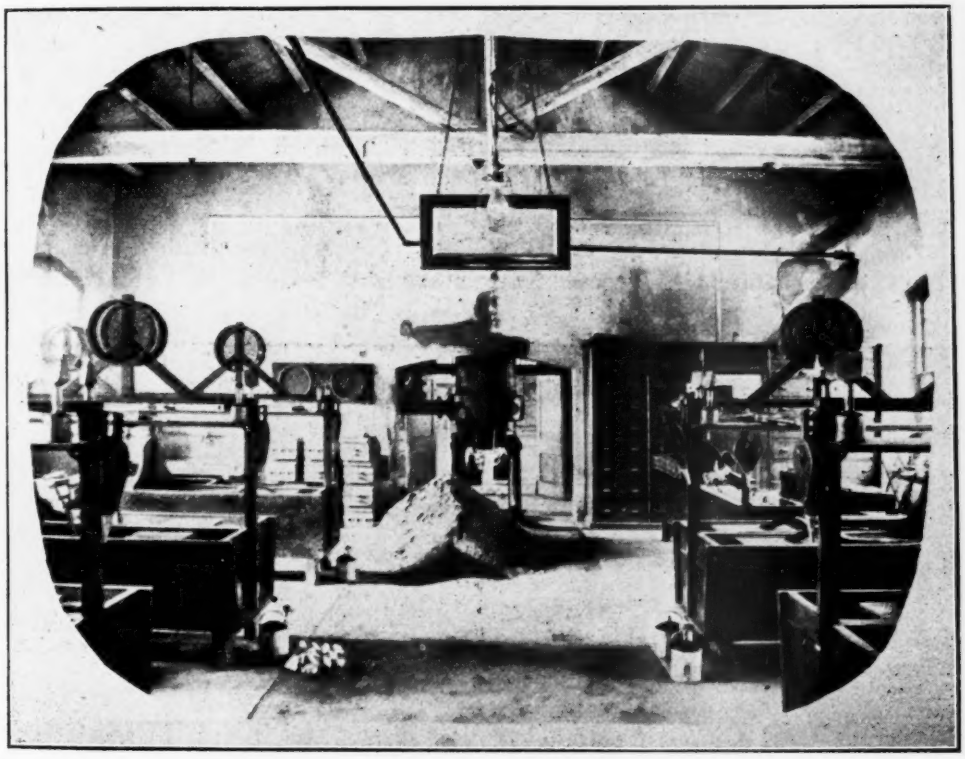
By M. F. CARR.

Your report in the November issue of the Western Foundrymen's Association on the apprenticeship system, has caused the writer to give in this article some facts and suggestions not generally known outside of Philadelphia.

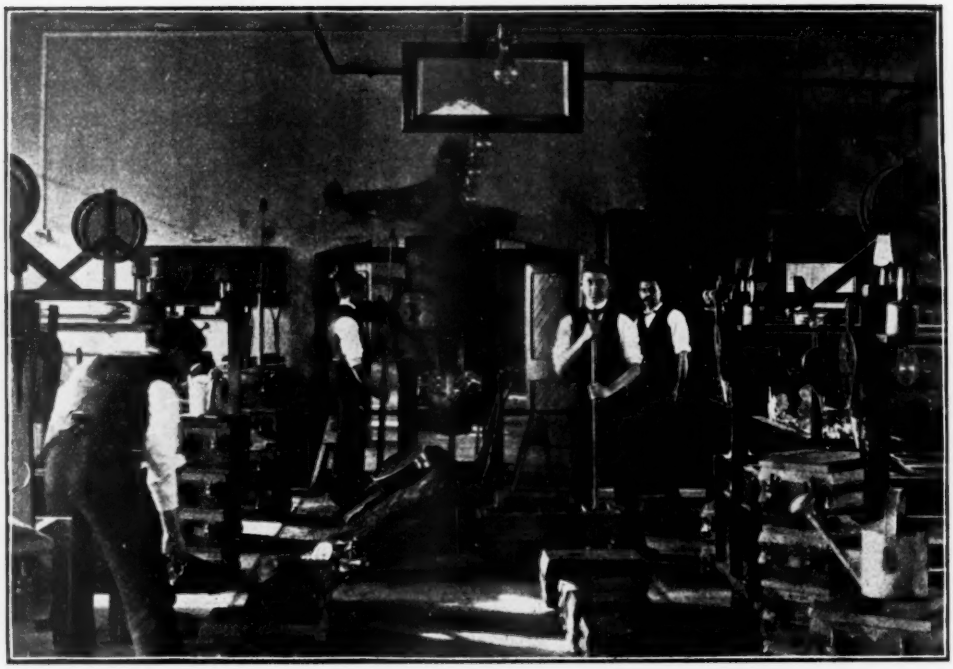
We have here in Philadelphia the Girard College, an institution richly endowed, that takes orphan boys as young as ten years of age; they remain until they are eighteen. During these eight years they receive a thorough college education, and in addition thereto a practical mechanical education. They have a completely equipped foundry for green sand floor work, and small bench work. They accommodate 24 students at one time, and have a cupola that they melt from 500 to 1,000 pounds of iron in daily. In addition to the foundry they have a core room equipped with six core benches and a Millett portable core oven; also a well equipped brass shop with two brass furnaces, and a drying stove for dry sand work in brass.

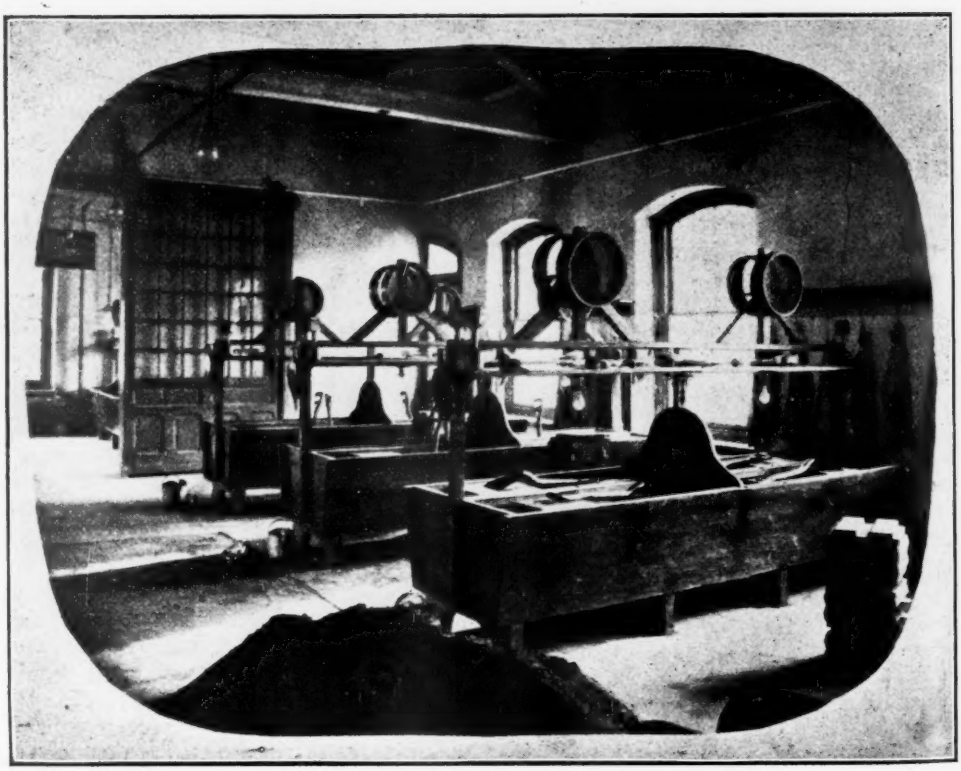
The instructor is a man well up in foundry practice, having served a long time as first assistant in the Baldwin locomotive shops of this city; no one stands higher in the business than Mr. W. Howard Echternach, the instructor.

It seems to the writer that this institution would be the place for foundry people to draw on for their apprentices, as these boys have a first-class college education, and are examined in the mechanical departments, the boys having the highest averages are the only ones sent out. For example, a foundry man wants an apprentice and writes to the college. The superintendent selects the boys from the foundry department who have the highest average. The same applies as to a coremaker. This college has furnished several apprentices to the Baldwin Locomotive Works for the



INTERIOR VIEW OF FOUNDRY, GIRARD COLLEGE.





ADDITIONAL VIEWS OF FOUNDRY, GIRARD COLLEGE.

foundry, as well as coremakers to the same firm.

I must mention another fact in connection with this institution; these boys are taught cleanliness, of personal appearance, as well as cleanliness and good order, in and about the department in which they are working. This one thing alone should commend these boys to the foundry people.

All castings required in the several departments of the college are made at their own foundry, such as pulleys, plain and cone, gear wheels, two-horse power steam engines, ornamental castings and statuary in either brass, iron or bronze.

Any further information desired by any one will be gladly furnished by the superintendent of the college, T. R. Coggeshen, who extends to all persons interested in foundry practice an invitation to call at the college and make a personal inspection.

Upward and Onward.

The Iron Molders' Journal has evidently made some New Years pledges, at least the first number of the year comes to us in enlarged form and contains a greater variety of topics than heretofore. The effect of a real live journal should be one of the greatest aids that could be offered to the molders of the land. Molders are made, not born, and the journal furnishes one of the elements that helps to make a successful molder.

The selection of Mr. Fox, by the American Federation of Labor, as a delegate to the British Trade union congress to be held in Birmingham, Eng., next September, is a most fitting testimonial to the high worth of Mr. Fox and a recognition of the fact, that the molders occupy a very important position in industrial affairs.

The "Progress of the World," in the Review of Reviews for January, 1897, gives an admirable resume of the great world-events of 1896. Nowhere else can so faithful and impartial a chronicle of these stirring times be found. This illustrated editorial summary in each month's Review is everywhere recognized as one of the triumphs of modern journalism. The discussion of the Cuban situation is enlivened by the reproduction of timely Spanish and Spanish-American cartoons.

Sulphur in Iron.

By S. S. KNIGHT.

It has been authoritatively stated that less than .5 of a per cent. of sulphur would not be in the least detrimental to any iron. Many foundrymen have accepted this statement without the least investigation whatever, while others who have questioned it remained passive. It may be here remarked that in reviewing foundry practices, it seems most wonderful that the processes of deductive reasoning, based upon the closest investigation, which have been so instrumental in advancing almost every other trade, have been basely underrated or absolutely ignored by the only persons who were in a position to obtain possession of the facts. In nearly every case superintendents and foremen have been willing to do as their predecessors had done, and not even make use of such suggestions as the very losses themselves thrust upon them. As an illustration of this, the author feels sure he will be pardoned if he cites an instance which he knows occurred in one of the larger foundries of the United States.

Losses were very high, yet good irons were used. Cupolas were heavily coked and fluxed with good stone, yet slag was retained by the metal. Large amounts of fuel were used and small amounts of blast and vice versa, still the difficulty could not be located. The castings were full of blowholes and the metal often set while being poured into the mold in spite of excessive phosphorus. Limestone and metal were both carefully analyzed, but nothing of value noted. Iron which contained less than .035 of a per cent of sulphur before melting, when cast carried from .09% to .1%. Test bars stood less than 16,500 pounds tensile strain, and their deflection was lowered 10 per cent. Still this was not considered to be phenomenal since the only authority on the subject said that more than five times as much sulphur would not be detrimental to the metal. At last the suggestion was offered that the sulphur be cut down, but repeated trials could only partially effect this. The coke was at last analyzed and with this result:

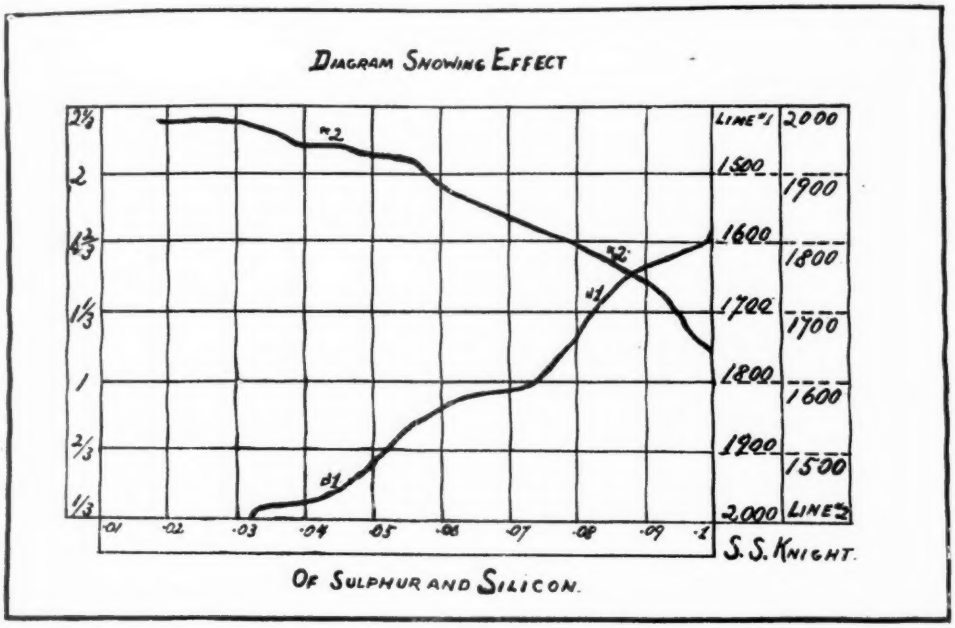
Moisture, volatile matter and fixed carbon..... .... 85.84 %
Ash.. .... 14.16 %
Sulphur 2.170%

This coke was discarded and other used which contained less than .7 of a per cent of sulphur. The difficulties were obviated at once. Even chilled iron was now free from blow-holes and no iron carried over .06 of a per cent of sulphur.

Subsequently a series of experiments were tried to find, if possible, a safe limit to place upon the quantity of sulphur an iron may contain. The conclusion arrived at was, that no metal which is to be chilled can safely carry over .05 per cent of sulphur, and that even loam and open sand castings should not, if tenacity and elasticity are desired, contain over .08 per cent of the element in question.

Of course, certain mixtures can be made where somewhat over that amount is carried and yet not seriously injure the metal. Such mixtures must be free from an excess of manganese and titanium unless the latter element exist entirely, as the carbide and the iron is very silicious. In all cases .5 of a per cent of phosphorus is required, and in no instance was over .8 of a per cent of total combined carbon considered beneficial.

It might not be inopportune to here remark that no coke should be considered as suited for foundry purposes that contains over 1 per cent of sulphur. It should also be noted that chemists often, in determining this element in coke, use the fusion method recommended by Blair. This method is open to the most serious criticism since the operator is unable to tell when the oxydization is complete. It is also to be observed that the chemicals which are required for this process, viz., sodium carbonate and potassium nitrate, are often with difficulty procurable in a pure state on account of the great chemism of the two base elements, and that even when a blank is carried the results are uncertain, since these chemicals are often not homogenous in their constitution. Personally the author prefers the method of Brezelius as found in any standard edition of Frenenius, since pure nitric and hydrochloric acids can easily be obtained, or if impure are homogenous, and hence their impurities can be easily and accurately determined. Potassium chlorate may be procured absolutely free from sulphur; that bearing Merck's signature having proved itself easily obtainable and perfectly satisfactory to the author. The reason this opportunity of criticising the first method is taken, is because homogenous samples of coke were



sent to reputable chemists asking for determinations. Of those using the first process no two checked, while three out of four using the Brezelius method concurred in results to the third place, and the fourth only varied .005 of a per cent from the other three.

Little has been written on the elimination of this element from iron. Many experiments have been tried, but all that have come under the author's notice were most unpromising in their results. It seems safe to consider as approximate truth that every time the metal is fused an increase of sulphur is sure to take place. The amount of increase is, of course, directly proportionate to the amount of sulphur in the fuel. Metal melted with charcoal will have less sulphur than that fused with clear coke; that fused with clear coke less than that melted with wall coke and so on. It is hardly necessary here to observe that estimating the sulphur in an iron only the sulphur that can be detected by the hydrochloric acid and alkaline solution method need be taken into account, since that only existed in the form of sulphide. If the total sulphur be desired the residuum must be examined and the sulphur existing as sulphates determined.

Irons may be quite high in total sulphur, and still the amount of that element existing in a form detrimental to the metal be comparatively small. As irons increase in slag the total sulphur is almost always very rapidly increased, while that existing as sulphide may not practically have changed. Hence it is easily seen why in an estimation of sulphur the method by which it was determined should also be known in order that a fair understanding of the case be had.

It would not be fair to leave this subject without saying a few words concerning some things which have been written under this head before. The author has seen somewhere the statement that in order to melt metal hot, a fuel reasonably free from sulphur must be used. Cases have repeatedly come under our notice where foundrymen had discarded a clear low sulphur coke and used a high sulphur coke in its place with the same blast, but with an increased temperature of the molten metal. It is a false theory that high sulphur and high ash are always co-existent. As proof of this the following analyses are introduced, the first of which was made upon a sample of a clear washed coke:

Moisture and volatile hydrocarbons..	2.56 %
Fixed carbon.....	84.48 %
Ash	12.96 %
Sulphur...	.6878%

The second was from a sample of high sulphur coke which contained but little slate:

Moisture and volatile hydrocarbons..	2.40 %
Fixed carbon	86.08 %
Ash	11.52 %
Sulphur	1.249%

As a rule it is by far the safest way to never use any fuel in a cupola that contains over .8 of a per cent of sulphur.

The same author positively states that if sulphur exerts any bad influence silicon will counteract it.

In the presence of what has been said, this assertion is illogical and absolutely false. The diagram here shown was constructed in accordance with the results of over 100 experiments, which were carried on through a time of nearly one year. The figures on the left refer to silicon, the quantities being given in per cents, and those at the bottom to the quantities of sulphur also as fractions of a per cent. The first column on the right refers to the breaking transverse strain of 1"x2"x24" bar cast on end, the results being summed up end in line No. 1. Those in the second column are applicable to line No. 2 in the same manner. The tests were all made on a Reihle Bros.' machine, the bar being loaded at the center. The phosphorus in all cases was between .650% and .725%, while the manganese varied but little from .6%.

Silicon in no known way tends to eliminate sulphur, and only the presence of phosphorus is known to give molten metal fluidity. As before stated, and as demonstrated above, even excessive quantities of both elements in no way qualified with certainty the detrimental action of sulphur. Only as the metal is kept free from such quantities as have been indicated is it safe for use.

In conclusion, the author gives as his belief what seems to him to be the greatest mistake of foundry-men to-day, namely: The confidence with which one element is played off against another in the mixing of

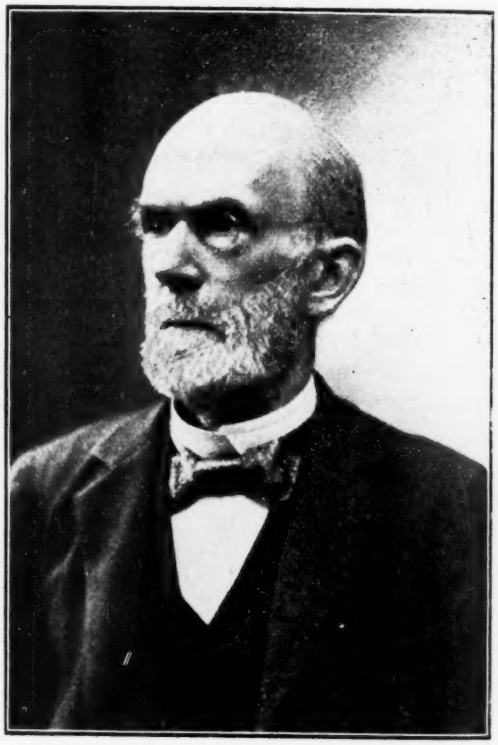
irons for ordinary purposes. Because silicon, by means of graphite, renders the metal porous and open, while sulphur gives decreased fluidity, closeness of grain with greatly augmented tendency to blow-holes, it should be distinctly understood that one element does not, in any part whatever, counteract or destroy the influence of the other. It is only as silicon acts upon carbon that density is diminished or porosity increased, and certain it is that neither of these results as produced by silicon exert but a very slight ameliorating influence over the harmful result of too large quantities of sulphur.

Robert D. Moore.

The subject of our sketch was born in Bridgeton, N. J., in 1821. At the age of fourteen his father, having built a vessel and adopted a sea life, moved to Philadelphia to be more in reach of his numerous family. After two sea voyages, the boy, at the age of sixteen, having developed mechanical tastes, found a place in the foundry of the well-known pioneer wrought tube manufacturers, Morris, Tasker & Morris, at Philadelphia. Among the apprentices he was rated as a quiet, and in fact, a rather dull boy, but he soon exhibited a strong desire to see to the bottom of the many mysteries surrounding foundry practice in those days, and his close reasoning enabled him to successfully cast several jobs that had been given up by journeymen molders.

The next few years were somewhat uneventful, though like the average eastern mechanic, he longed to see the great west. Arriving in Cincinnati in 1847, not dreaming of more than a year's western tour, he went to work for Miles Greenwood for six months, then pulled up stakes for New Orleans, with a view of seeing the country and also for the chance it afforded him to see his father, who was then sailing a vessel in the Bordeaux, France, trade. After spending a short time sightseeing in the city and on plantations, he returned to Cincinnati and went to work in the Niles & Co. foundry, where he remained nearly twenty years, being given the foremanship four years after entering their employment and retaining this until 1866, when that firm retired from business, having lost heavily through bad management, in spite of the large business they transacted with the south in sugar mills, steamboat engines, rolling machinery, etc.

As an example of the class of work turned out by this firm we may mention the Shields Engine for the Cincinnati Water Works, built in 1858, and at that time said to be the largest engine in the United States. It had a 100-inch cylinder, having a twelve-foot stroke. This casting weighed twenty tons, and this job alone with pumps and some 51-inch pipes weighing from 10 to 18 tons each,



ROBERT D. MOORE.

aggregated over 600 tons of loam work alone.

At this time Mr. Moore acquired some of the most practical experience, that has clung to him to this day. Many plans for turning out this work were matured in the still hours of the night, with the candle burning low, and it is to his credit that only a few losses attended the filling of this important order, and each of these was directly traceable to an incompetent manager who insisted on having his own way in spite of the protests from the foundry. Some of these

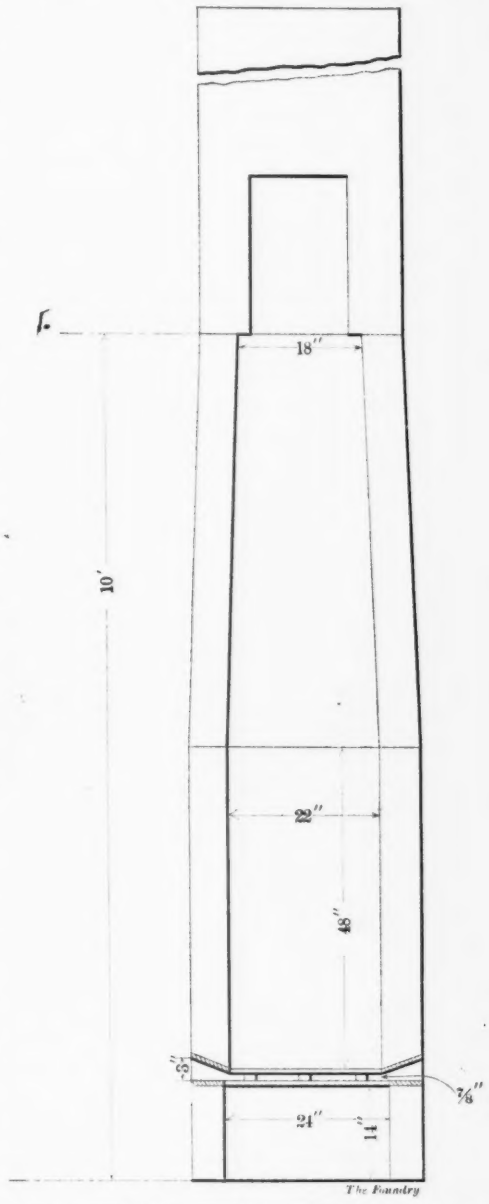
instances of mismanagement savor so strongly of the present day flavor, that we will repeat them. One of these failures was caused by trying to pour a large elbow with a number of small ladles to save buying a larger one; result, a cold shut casting. Another was caused by the manager attempting to save money by using a weak loam ring under a casting fifteen feet deep. This made a wiser manager and a bad piece of work. The final conception of economy on the part of this manager of thirty years ago, was in charging up a sixteen-ton air furnace with an overdose of burnt grate bars. The casting was all right in appearance but its composition resembled that of a file so strongly, that it could not from the standpoint of financial experience be considered a success.

Soon after leaving the Niles Works he took charge of the foundry of R. Moore & Sons, but two months later he accepted the position of foreman with Miles Greenwood, of Cincinnati, where he remained until that firm retired from business in 1873. After a few months he was sent for to conduct the foundry at Van Wert, Ohio, that company having bought the paper machinery business of the Miles Greenwood Co., when they found that there was an elephant on their hands, due to the perfect castings required in rolls for this class of work. Mr. Moore removed this difficulty and returned to Cincinnati in 1874, where he was engaged by the McGowan Pump Co., to handle the numerous large orders for pumping machinery which this firm was at that time filling.

This position he retained until 1878, when he was offered the foremanship at J. & E. Greenwald & Co., of Cincinnati, where he remained over eighteen years, or until October, 1896, when he resigned his position principally on account of his advanced age, being then past 75 years old. Mr. Moore has the distinction of having made one of the longest records in continuous and active foremanship. He has been and is yet, one of the most observant men in the trade. Improvements have been introduced by him in every shop with which he has been connected from boyhood to the last of a useful career. With more like him, ready to help themselves to a higher knowledge of the trade, the apprenticeship question would soon be settled.

A Home Made Cupola.

We send you a rough sketch of our cupola. It is a home-made affair, but works well, and never gives any trouble. The tuyeres are two plates made in sections and running



clear round the cupola. The lower one is six inches wide and is nearly level; it is even with the inside of the part of the cupola below the tuyere, which is of 24-inch dia. The upper plate is a 7-inch wide, and

overhangs the lower one one inch, and is also even with the part of cupola above tuyere, which is 22-inch dia. The upper plate is set on an angle making an opening for wind all around at inner edge of seven-eighths of an inch, and three inches at the shell. Both plates are flaring out on the two opposite sides where the 7-inch wind-pipes enter. The overhang of the upper plate prevents the melted iron or slag when descending from entering between tuyere plates. We melt on an average about 2,000 pounds iron each cast; we use one-half or over of scrap (light machinery and stove scrap), balance of No. 1 Summerlee or other good pig iron. We make all kinds of light machinery castings and jobbing work.

It may be of interest to the consumers of pig iron to know that Hugh W. Adams & Co., pig iron merchants, of No. 15 Beekman street, New York, and No. 85 Water street, Boston, were the first introducers of Southern Sloss Pig Iron to foundries in the Eastern States. At that time, Southern irons were little known, and were looked upon with great apprehension by melters, who felt that the iron would not fulfill the requirements, in making castings, of sufficient strength, softness and free from porousness. To overcome this incredulousness and imaginary uncertainty, Messrs. Adams & Co. labored hard and assiduously, until they have made Sloss Pig Iron, next to a necessity, to nearly every consumer in this vast manufacturing territory.

The smoothest kind of a catalogue comes to us from the Jos. Dixon Crucible Co. It typically represents all of the productions of this firm from lead pencils that leave smooth writing, core wash that furnishes the smoothest kind of castings, to lubricating graphite that makes everything run smooth from bicycles to locomotives. The aim of the Dixon Co. has always been to reduce friction, and if the world revolves easier year after year, it is in a great measure due to their efforts.

Reynolds & Co., of New Haven, Conn., have sent us their latest catalogue of Molding Machines, giving a brief review of the advantages they possess. A large number of testimonials are appended, showing with what universal satisfaction they have been received by the trade.

A Large Gate Valve.

We present herewith illustrations of a gate valve of more than ordinary dimensions that has recently been cast at the Centre Island Foundry, Troy, N. Y. It was molded

in dry sand, but even then its construction was not without difficulties, as the casting is covered with innumerable ribs, forming complicated pockets four inches wide, and

in places reaching a depth of twelve inches.

The diameter of this valve is 72 inches. It weighs ten tons, and is a piece of work that would reflect credit upon any shop.

CAST IRON NOTES.

Devoted to Inquiries from Practical Foundrymen on the subject of Melting and using Cast Iron. Address all Inquiries to W. J. KEEP, care of The Foundry.

What is the Best Iron for Plow Points?

Since you live in Michigan you can get a chilling charcoal iron at a reasonable price. Don't get a non-chilling charcoal iron, such as the malleable people use. White iron is not necessary "chilled iron," in other words, is not always hard iron. Some of it is quite soft. If you were located where charcoal iron was dear I would advise the use of old car-wheels which are made of chilling iron. Any iron that will take a white hard chill will make good plow points. If you remember that there is white non-chilling iron which is somewhat soft, and that there is a white chilling iron that is very hard, you will soon find where to get the iron that will suit your purpose.

Making Castings from Silvery Iron.

Some days ago I received a box containing several pieces of pig iron and the accompanying letter said: "This pig does not work entirely satisfactory to us, the casting is hard, very hard, and breaks and cracks when making fly or balance wheels with spokes. Now and then the rim will crack?"

Answer: It is a common experience to have the spokes crack when using iron containing from 1.50 to 2.00 per cent. of silicon, which would be proper for such heavy castings. The cracking of the heavy rim is an opposite experience. I seldom say in print, but do sometimes in a personal letter, that a person who is engaged in foundry business should at least understand the nature of cast iron, and I advise the use of a test of shrinkage which is a mechanical analysis for silicon. If the silicon was anywhere near 2 per cent. the shrinkage of a half-square test bar one foot long would be about .165. If the arms of a fly wheel cracked and the shrinkage was .180 the silicon would be near 1.50 per cent. An increase of silicon so as to bring the shrinkage to .100 would probably prevent cracking. In making such heavy castings if the shrinkage is below .160, more scrap iron could be used. Any founder will do this much in the line of testing, if he realizes that he will often save more than his present profit amounts to.

The iron sent me in the box was a very good grade of silvery iron and should have cost several dollars a ton more than No. 3 pig, which it was probably purchased for. The broker or the furnace who sold it did not know what they were selling, and certainly if a founder should be fortunate enough to buy No. 3 and receive a silvery iron, he would lay it aside to use as he should need it, but a founder who does not know a good thing when he sees it will lose money and blame every one but himself.

Mr. George H. Ellis, chemist, at 116 Randolph street, Chicago, found that this pig iron contained 4.01 per cent. silicon. By adding enough good scrap or No. 3 pig iron to bring the shrinkage down to .160, this silvery iron will be found to be a good softener.

The way to use silicon iron is to make a mixture of scrap and cheap pig iron, and if the shrinkage is not low enough add just a little silvery iron to soften it. Too much will produce spongy grain, and much over 3 per cent. of silicon will produce brittle castings which will be hard.

Stove Plate Scrap.

"In 'Cast Iron Notes' you mention stove plate scrap as containing about 2.75 per cent. silicon, and machinery scrap 1.50 per cent. My experience has been that stove plate scrap requires a pig higher in silicon than machinery scrap to produce castings possessing a certain degree of softness. I know a number of foundries who are adverse to buying stove plate scrap as it has a tendency to harden their castings, while they willingly accept machinery scrap and find it to compare favorably with a No. 2 pig. If your assertion as to amount of silicon is correct, please answer why stove plate scrap will produce a harder casting than machinery scrap?"

Answer: Are you certain that in your experience and in that of others, stove plate scrap produces harder castings than scrap containing 1.50 per cent. silicon? Stove plate is less than one-eighth thick and must run soft in the thinnest edges and must flow over surfaces more than 24 inches square. A chilled edge would ruin a file at once. Stove plate is made from all pig and it must be non-chilling, fluid and soft. Forty per cent.

of the iron poured is made into sprues and is returned to the cupola next day. This remelting and the thinness of the castings causes the grain to be very close. Any iron with close grain that is put in the cupola will make closer grained castings than if coarse grained iron with the same silicon had been used. Fine grained castings are generally stronger than those with coarse grain. If stove plate is made from the quality of pig iron above described, the remelting and pouring into a very thin casting will not take out the softness of the original pig, though it has closed the grain.

If stove plate scrap shows a dark gray fracture and the edges are not chilled, it can be relied on as equal at least to No. 2 pig iron.

If this were not so the claim that iron should be purchased by its silicon analysis and not by its grain, would be wrong. The trouble with stove plate scrap is that it is covered with rust and dirt and the iron is therefore not as cheap as it appears. A large portion of stove plate scrap consists of fire-box linings and grates that have been burned. This contains very little silicon and should in all cases be culled out and sold for sash weights. In speaking of stove plate scrap, I meant stove castings which had not been in direct contact with burning coal. Good stove plate when remelted and put into machinery castings will always be soft, and if the castings have any enlarged sections there will be danger of shrink holes.

The rule that silicon softens up to at least 3 per cent. generally holds good.

CORRESPONDENCE.

Editor The Foundry:

I believe that foundry work is fast becoming (as it should) a science instead of a craft, and that more especially in America, I am pleased to find.

I am convinced that if we mean to advance, the foundry is one of the first and most important branches of an engineering establishment to be scientifically overhauled. Now, there is one thing which seems to worry me, and that is the want of international standards, and if a good system of international standards were adopted, we should be able to advance much quicker. I throw out this suggestion for your readers to think over, and your various societies to discuss. Here is a point on which to start, namely, test bars. These have been made in many sizes, which make comparisons difficult. There is no need for a test bar to weigh more than a few pounds, as they are much handier to make, and also to use.

What I have found a handy size is 20 M.M. (.78") square, and 200 M.M. (7'8") long between supports, breaking between 800 and 1,200 kilograms (1,600 and 2,500 lbs.).

As chemistry will be a great help in foundry work, and chemists have adopted the sensible metric system, perhaps it would be wise once for all to adopt some such dimensions as those above stated.

G. M. RICHES,
Dec. 5, 1896. Azalea, Suffolk, Eng.

The Vicissitudes of an African Foundry.

That the foundry business does not always run smooth, even when there are no molders' union, apprenticeship question, or competition to interfere, is seen by the following letter from Edward Taylor & Son, of Tangier, Morocco. We will leave the readers of THE FOUNDRY the task of separating the humorous from the more serious problems that seem to confront our correspondent:

Editor of The Foundry:

We have your letter of the 24th of October, and a sample copy of THE FOUNDRY, duly, or rather, overduly, to hand, for which we thank you. We also thank you for your kind offer to assist us in the event of our trading with, or requiring any metal from, the United States, and will gladly avail ourselves of your kindness should the occasion offer.

The most interesting part of your letter, however, is that in which you wish for information as to the state of the foundry trade in Morocco. In compliance with your request, we enclose a combined interior and exterior view of our foundry, which will, no doubt, interest you, as it shows a great difference of appearance if compared with, say, a modern American foundry; we are but amateur photographers, and we are rather afraid the photo enclosed shows an abundant lack of development, but whether it is the plate or the foundry that requires developing, we leave for you to settle when you have finished this.

(The combined interior and exterior view spoken of above, consists of a blank card, by which we are even enabled to see around the corners of the place.—Ed.)

To start from the beginning, as far as we can go back, and our family can go back a quarter of a century in this country, it has been the custom, from time unknown, to cast all the bronze coinage, but the supply of this cast money is gradually diminishing, owing to the more convenient 10 and 5 centimo Spanish coins. We are sending you under separate cover some samples of these bronze coins, which show very clearly that they are cast in bars and then broken into separate coins.

(The coins referred to are made up of a number of circular discs, of uneven thickness, without any lettering, and appear as if they had been cast in open sand, as the edges of the majority are what is termed in foundry parlance, "run short." No attempt has been made to make them uniform, and on nearly all of them part of the gate is yet attached after probably a hundred years' continued use.—Ed.)

The largest coin is twice the value of the middle-size coin, and four times the value of the smallest coin; it takes 500 of the largest, plus 500 of the middle size coins to make one dollar, which is also the value of 3,000 of the smallest coins. These latter are getting very scarce now, and seldom seen. One pound weight of these coins has an approximate value of 7 cents of a dollar. We have no compunction in putting a shovel full into a crucible when we want some cheap castings, but as we do not know how to analyze the alloy, we do not care to use it in any important casting, and our experience with it has not been sufficiently long to enable us to judge by results. It, however, is soft, and appears to contain a large percentage of lead.

These coins and the waste chips of yellow metal sheet used in brass tray making, which can be bought at almost as cheap a rate, are the only metals used by the brass founders of Tetuan, who turn out brass candlesticks and household mortars and pestles. The heaviest castings rarely exceed 15 lbs. in weight, as the crucibles are home-made of a species of fire-clay, and do not possess strength. However, one rarely wants a candlestick heavier than 15 lbs., and the Tetuan Jews, who run this trade, do not want better crucibles, but are content to do as their forefathers did.

Until a few years ago, when an occasional cast iron stove began to be seen in a few European houses, the only cast iron to be seen in the country consisted of several hundreds of old King George's cannons, evidently the result of a considerable transaction between the governments of the U. K. and this country. With these exceptions and the cylinders and bedplates of a few small steam engines, scattered over the country, cast iron was unknown in this country, and an iron foundry never heard of.

Late in 1893, an enterprising Portugese molder borrowed some money and came over here. He brought a partner, who was a smith, and together they started a smithy and foundry. His was a home-made cupola and fan, and the borrowed money bought five tons of pig iron and a few firebricks.

We own a small engineers' repairing shop. There are three small steam engines at work in this town, and sometimes they want a new stud or a valve face trued up. We do it for them; consequently it was very convenient to have a foundry handy, and we gave them all the work we could. As you will understand, there is no scrap iron to be got here, unless imported, as the government won't sell their old cannon, and you can't steal them easily. The result was that at the end of two years his five tons of iron had run dry, and there was no money to buy more. His partner left the country to seek a brighter spot, and the molder could not persuade anyone to go into the iron foundry business except ourselves, for, as we said before, we found it convenient to have a foundry handy. We bought his entire plant and dumped it down in a corner of our yard. He paid his debts, and then came to work for us, as, of course, you will readily understand, a molder is a handy thing to have about a foundry if you intend establishing one and are only an engineer yourself. After this, the iron foundry business in Morocco was dull, but after about nine months there came a rush of business, and an order for two hundred-weight of fire bars woke us up. The two feet fupola was too big for this job, and, besides, wanted a lot of alterations to make it anything like modern in appearance; so we rigged up a small cupola, 1 foot internal diameter and 9 feet high, fitted two tuy-

eres and connected them to the home-made fan, and drove it with six natives on a fly-wheel; we sent to England for five tons of No. 3 pig, and, mixed with old fire bars, completed this order without making much money.

After this spurt, things went dull again, until one day a bricklayer came in, and wanted us to cast him a grating for a kitchen sink off a broken one which he brought for a pattern. He offered us five (American) cents for it, if we would cast it right off, as he was in a hurry. The offer was a tempting one, but, after due consideration, we decided not to undertake the job, as our stock of iron was small and the price of pig rising. Then came an inquiry from Fez, one of the capitals in the interior, for the price of a cast iron flower pot, for which we tendered, and are daily expecting the order.

As you will see by the above true and almost unvarnished account of the iron foundry business in Morocco up to the present day, things look so bright that we have been tempted to put a corrugated iron roof over the place where the molding sand is kept, so as to keep the rain off. This we are very busy doing just now, and we hope to have it covered by the time the order comes from Fez. In time we shall have a motor instead of natives, to drive a better fan, and will build up the 2-foot cupola in a suitable place, and will then turn our energies towards developing a taste for cast iron work in the people of this country. Although we are afraid it will be some time before the natives will take to cast iron lions when, by moving a few miles further south, they can get live ones for the trouble of killing them. (We are not Irish.)

We will not charge you anything for this history of founding in Morocco, as it does not contain anything worth publishing, but in consideration of the time it has taken us to write it up, you could not very well do less than send us that back number of THE FOUNDRY which, in your opinion, is most likely to help us to make the most of our five tons (now reduced by 1 cwt.) of No. 3 Glengarnock pig. As this lot is likely to last us several years, we do not feel any inclination to invest money in other brands of pig iron, and must regulate our mixtures, the best way we can, by carefully sorting out whatever scrap iron we can get hold of.

It is possible that the foundry industry here may improve in the course of another 25 years, and we shall be very pleased, indeed, if we are able to send you further particulars by that date. Until then, believe us

Yours faithfully,

EDWARD TAYLOR & SON.

Tangier, Morocco, Dec. 8, 1896.

Meant to be Funny.

BY F. S. BARNETT.

Is a molder a carpenter when he cuts a "gate"?

Should he be funny when he sees a "riddle"?

Does he have a hard lot, when he has so many things to "cope" with?

Had he ought to complain when he has "a snap"?

Should he expect more salary when he gets a "raise"?

Is he a sprinter when he is always among the "runners"?

Does he have the malaria when he has a "cold chill"?

Why should he kick on leaving, when he has made so many "partings"?

Should he fight, when he falls among the "soldiers"?

Is he a master workman when he has his "strike off"?

The Tradesman (Chattanooga, Tenn.) in its eighteenth annual number furnishes a veritable mine of information. It comprises over 260 pages, filled with special articles from such contributors as six southern governors, the chief statistician of the United States census bureau, twelve leading southern journalists, twenty leading southern chamber of commerce officials, such writers as Edward Atkinson and a score or more of statistical writers and industrial authorities in their special lines, whose reputation is national and international.

The Tradesman has proven itself a powerful factor in the development of the "New South." That its labor has not been in vain, is attested by the directory of 5,000 leading industrial plants of the southern states.

In the year 1500 the entire iron production of the world was estimated at 60,000 tons; in the year 1890 it was estimated at 25,160,000 tons.

Questions and Answers.

Editor, The Foundry—Your question, as to the average cost per ton for foundry labor in making such castings as general engine work, is before me.

For the last few years I have given this subject considerable study. In a modern up-to-date foundry such castings as you speak of, ought not to cost over 1¼ cents per pound. Large pinions and brake shoes could be made for much less.

Yours truly,
C. W. BOUTELLE.

Orange, Mass.

Editor, The Foundry—It is with peculiar interest I read the account of the experiment J. G. B. has made with his large cupola. Saving thereby a large amount of labor in cleaning out and putting up the bottom. Getting ready early in the day without any difficulty or trouble, not needing to use any sand for the bottom, or any kindling to light up his coke.

The saving in cost and time must be a very large item, not to speak of the very high ratio of iron melted to coke used per ton.

Never having such a large cupola under my care, I have been sorely troubled with "bunging up," when melting large heats, which made dropping the bottom a necessity more especially when using 48-hour coke. At such times there would be no hole in the cupola at all, when the labor of breaking through and picking down the mixed cinder and iron would be very great indeed.

The accumulation of debris starting just above the tuyeres and continuing up the sides for about two feet, would form an arch which (depending on the amount of iron which would have set throughout it) would be very hard to break down and clean out. And the idea of melting down and filling in a good charge of coke on top of the scaffolding in that shape never once presented itself. Does J. G. R. have the above to contend with, and if so, does the coke put in melt down the scaffold, so it don't trouble him next day, or interfere with the cupola's melting?

I have done the same thing repeatedly when a breakdown job came in near the end of a heat when we would have to wait several hours before the job would be ready to cast, and got splendid iron, but the amount needed would not be very large—perhaps three or four tons--and had a good drop, the heat before running from 25 to 30 tons in a 48-inch cupola.

I would like to ask, does the gentleman use lime for a flux, and how much? Does he use a slag hole to run off his slag, and how much per ton of iron? How far is it above his bottom? Does he use 72-hour foundry coke, or take what the purchasing agent is pleased to buy? How much blast pressure has he, and what blowing machine does he have? Is it near the cupola, or at a distance? And how does the cupola look when the bottom is dropped? I think in discussing this feature of cupola practice, the above questions need to be taken into consideration.

There is another thing especially mentioned, which, in some way, may contribute to the success of the practice. After the iron and slag are all drained out, the breast cut out, the coke pulled down to the front of the hole, the contents are wet down when the slag and cinder are punched away from the tuyeres. Is the wetting done so that the slag and cinder can be easily chipped, or to reduce the heat so that the fresh fuel put in will only smolder all night, and not burn away and be entirely wasted? Then the usual bed is put on or filled up to 18 inches above the tuyeres, and again wet down. Now does our friend think that the water used simply retards combustion, or has he some other objects in view?

I know one man that makes a practice of wetting down his coke every day, and he claims that his practice is better than if he used dry coke. I also know another party, who noticing his cupola melted better and he had hotter iron when his coke was soaked with rain than when it was dry, now turns on a stream of water from a three-fourths inch pipe at the charging door, when he puts on the blast, and claims that he gets better and hotter iron than when he don't use it. I also know a great many men who shake their heads in incredulity when told anything like the above. But are there not many things, Horatio, that are not dreamt of in our philosophy.

Like J. G. R., I hope the discussion of this subject will not stop here. J. P.

Editor, The Foundry—I was very much interested in the article that appeared in the

holiday number of The Foundry, written by J. G. R. I have never heard of a cupola being used three or four times in succession without dropping the bottom. Would be very glad if J. G. R. would give a more detailed account of his experiment. There are several things that I cannot see how he overcomes. The first is, the difficulty in cutting the cinders and slag away from the tuyeres. Certainly the cupola is too hot, for a man to go inside, and I should think it could not be done very well from the charging door. If he should attempt to do this from the outside, I should think it would leave certain projections which would have a tendency to cause the cupola to bridge, and the melting point, with each successive heat to creep up gradually toward the charging door. I would like to know how he manages to patch up and daub out certain cavities, that are liable to be found, after taking down a large heat. Also how he gets his wood in, and keeps it from igniting at once, as this is a large cupola and to turn the hose in to cool it down sufficiently to enable a man to work inside, would saturate the lining pretty thoroughly. It appears to me that what he gained by not dropping the bottom, he would lose in the amount of extra fuel he would consume in drying out a wet cupola the next morning, to say nothing of the wear and tear, which this would cause on the lining. Let us have more on this subject J. G. R., by all means. E. E. W.

Editor, The Foundry—The question about the cost of such casts as for engine-work, boiler-fronts, gears, pinions, brake-shoes, etc., is a rather ticklish one to answer. It will bring forth a greater diversity of opinion than the melting question.

Taking heats of 15 ton for a basis, allowing fair average wages and the present price of iron, my experience is:

Molding, carpenter, core-making, facings and salaries	$ 7 20
Melting, chipping, grinding, etc.	93
Iron and Coke	12 05
Castings, per ton	$20 05

Every foundryman knows that there are too many factors to be taken into consideration to get at the bottom prices and I don't see the necessity of going into details, but give the above figures as a year's average.

It being a question of vital importance, I hope to see the subject thoroughly discussed in The Foundry. T. F. A. L.

Editor, The Foundry—In looking through your invaluable journal, I see W. I. C. asks that some of the readers of The Foundry advance their ideas as to the best way of overcoming segregation in car brasses. I would say that the best way is to prevent the car axles from getting heated.

If the gentleman is in a position to follow up the history of each car brass, even on a limited scale for some time, I think he will find that the reason given is the correct one.

Bronze will not segregate with fair usage at a temperature less than 200° F., but when journals get so hot that they will blaze for quite a long period of time and raise a large amount of steam when cooled off at some station, segregation can be counted on without fail..

In this connection it may not be amiss to mention that the Elephant Brand of Phosphor Bronze will stand the highest temperture before segregation of any I have yet seen. J. P.

Editor, The Foundry—Replying to your letter of inquiry as to what I would consider the average labor cost of making such castings as general engine work, boiler-fronts, gears, large pinions and brake-shoes, would say that is an unanswerable question as it is stated. In figuring labor cost it becomes necessary to know not only that it is engines but what kind of design, whether simple or complicated, also sizes of same, the same hold good with boiler-fronts. I know of designs in this line to cost $15 per ton for labor in foundry, and others that would not exceed $10. So it is true of gears and pinions, so that to give any fair reply to your queries it will be necessary to have more information and the shop and equipment is a great factor, also the quantity of the various sized engines or machines built at one time, and whether there is much fluctuations in the business of the concern. I am of the opinion that the only fair way to treat such a question is to make an individual case of it and state all the conditions then you may hope for a satisfactory reply. WILLIAM FERGUSON.

4120 N. Ashland Ave., Chicago.

P. S.—Price paid for the different kinds of labor is also necessary as this differs according to location.

Editor, The Foundry—The greater part of our work is dry sand and loam, it costs us from 1 ⅞ cents to2¼ cents per pound, some months when we have a great deal of loam work it will run as high as 2¼ cents per pound. Some years ago we took quite an order from the C. & O. R. R. for brake-shoes and railroad work in general. We kept a separate account of that work and it cost us 1 2-10 cents per pound to turn out that class of work. S. J. W.

Newport News, V., Dec. 29., 1896.

Editor, The Foundry—In regard to foundry labor in making such grades of castings as engine castings, boiler-fronts, gears and pinions and brake-shoes, the cost, in a fairly well equipped foundry with modern appliances, would amount to:

Engine castings .....about 70c per cwt
Boiler-fronts .... about 66c per cwt
Gears and pinions ..... about 60c per cwt
Brake-shoes .... about 35c per cwt
Making a total average of 59½c per cwt

These costs are computed on a basis of union wages and a medium demand for such castings, for the cost of making any kind of casting in a foundry is lessened very much by a large or continous demand.

Brake-shoes have been made, under such conditions, as low as 12½ cents per cwt.

J. G. S.

Editor, The Foundry—Regarding the cost of labor in foundry on castings for general engine work, boiler-fronts, gears, large pinions, brake-shoes by labor, I take it that you mean cost of molding same by the pound. I would say in advance that in order to obtain the results I enumerate that it is necessary that the foundry must be equipped with the most modern and improved machinery. The engine work I put in two classes, namely, slide valve engines and automatic compound condensing engines. On the slide valve engine castings the molding could be done for 25c per cwt.; automatic, from 35c to 50c per cwt.; boiler fronts, 12c to 15c per cwt.; large pinions, 15c to 20c per cwt.; bevel gears, 25c to 30c per cwt.; brake-shoes, 10c per cwt.

The above prices are estimated on the basis of paying the molder at rate of $3.50 to $4.00 per day. I have found always that by proper management I could obtain more and better work for less money from a first-class molder than I could from second rate molder at any price I had to pay. A good deal depends on the management of the foundry and the major part on the foreman as to getting down the cost of castings.

The writer is superintendent of a large firm employing seventy-five molders and know that the foundry is a part of the business requiring great attention and the necessity of having a good, live foreman, with good judgment and who can handle men to best advantage.

CHARLES JOHNSON,
Supt. Howe Scale Co.,
Rutland, Vt.

Editor, The Foundry—We do not find much trouble with our heavier castings, but find thin or light ones often chilled too hard to drill or machine. What would be the proper method of charging our cupola, with coke and iron, to get best results.? Give the weights we would require to use and also state your opinion regarding the use of limestone or other flux and best method of using them. Our cupola is 22 in. diam.; height from bottom plate to tuyeres, 14 in.

Y. B.

For a 22 in. cupola, with the height to tuyeres that you mention, 14 in., which, allowing the sand bottom to reach a depth of 4 in., will leave a distance of 10 in., it is a safe rule to make first charge of fuel 275 pounds, first charge of iron 800 pounds, succeeding charges of fuel 45 pounds and of iron 400 pounds. As each cupola is a law unto itself the above rules are only general. Familiarity with a cupola should result in a slightly less consumption of fuel than what is given above. As you say that you experience no trouble with your larger castings, but that it is altogether the small ones which show a tendency to become hard, we should say that the pig iron you are using does not contain enough silicon to carry the amount of scrap charged with it. You may satisfy yourself on this point by reducing your scrap. It should be borne in mind that most of the irons we are wont to speak of as good irons,

are very poor scrap carriers. Instead of insisting on buying a good strong pig, we should advise you to purchase one with a reputation as a softener. As you seem to have plenty of scrap, you will have no trouble in making a mixture therefrom, that will be strong enough for such work as you are doing.

As you are making light and heavy work together, we should recommend that you attempt to have a softer iron for the light work. Heavy work cast from the same iron as light castings will be softer and easier machined.

Considering that your heats average but 2,000 pounds each, we don't believe that you would obtain any benefit from using a flux. The object of such is to retain the slag in a fluid state until it can be withdrawn from the cupola, and it is not used with the intention of effecting any special quality of the iron. As the short heats you are running does not necessitate slagging no good would come from using flux of any kind.—Ed.

Editor The Foundry:

If W. J. C. will particularly describe what is meant by "segregation in car brasses" I may be able to help him.

Lima, Ohio. JOSEPH WHITE.

Editor The Foundry:

I notice a request in THE FOUNDRY for information as to the best methods of using cast iron dies so that they can be removed without trouble. I have had some experience in this line and troubles too, and it may be that by stating my way of using dies, others will be saved from scratching their head and wondering what is the cause of it all and the remedy therefor.

The questioner says he uses a die in a sheave wheel. I think then, that the spokes are flat and join the hub in the center, (with the pouring gates cut on opposite spokes) making that point the heaviest part of hub, which naturally would shrink the most. By calipering the hole after casting you will have the proof of the statement. But it does not stop here, your die gets the hottest where the largest volume of metal lies and will expand each time as much as the casting shrinks. It is also getting larger every time it is used. After being used from 5 to 8 times in casting, the only safe remedy for this defect is to have the die taken to the machine shop and turned up again. I have found this the most profitable practice, but if others know of a better method will be glad to hear from them through THE FOUNDRY.

The best wash for a die to my knowledge is coal tar applied after heating the die just hot enough so that it will have a nice glaze, a little practice will determine the temperature necessary. One advantage of this wash is, that it is not affected by remaining in a mold for any length of time, after it is closed, and will insure a clean casting without blowholes.

Lindsay, Pa. A. L.

New England Foundrymen's Association.

The regular meeting of the New England Foundrymen's Association was held at the United States Hotel, Boston, Mass., Wednesday evening, December 9. There were 21 present, and 16 foundries were represented. Officers were nominated for the ensuing year, after which B. N. Shaw, of the Walker & Pratt Company, entertained those present with a brief outline of the way the cost of stoves is kept as adopted by the National Defense Association. Mr. Walker, of the same company, then asked for a discussion of the following topics: 1, "Is It Necessary, in Providing Wash Rooms for Molders, to Have Separate Apartments in Same?" 2. "What is the Best Method to Shade Windows on the South Side of Foundries to Prevent the Glare of the Sunlight?" After an interesting discussion on the above subjects the meeting adjourned. The next meeting will be held at the United States Hotel on the second Wednesday in January.

McCullough-Dalzell Company, crucible manufacturers, of Pittsburg, Pa., have started their works on full time in all departments, after the usual holiday shut-down.

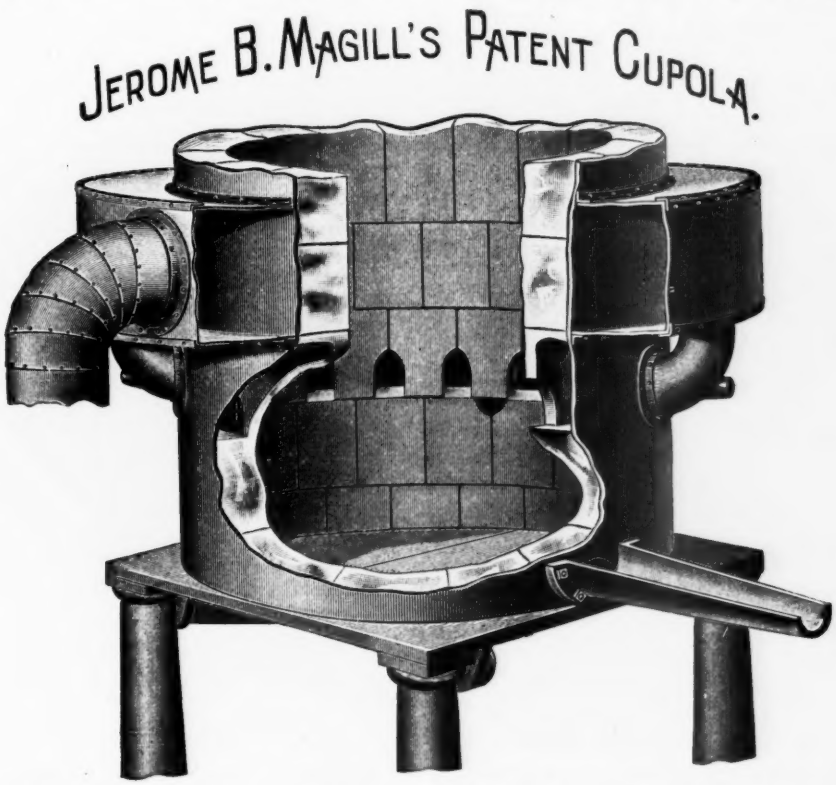
The Springfield Foundry Co., of Springfield, Ohio, are mailing a postal card ad. of their "Perfect Sand Riddling Machine" to the trade.

Iron is the only metal which appears in more than one color. It is found of every shade, from almost as white as silver to as black as charcoal.

The Magill Patent Cupola.

We present herewith an illustration of a cupola brought out by Jerome B. Magill, of Moline, Ill.

The distinguishing feature of this cupola is the inside air chamber, formed by firebrick of a special shape, which, at the same time, form the tuyeres, making what is practically a continuous tuyere and doing away with the customary cast iron tuyere found in other cupolas. It is claimed that this method of constructing tuyeres facilitates the daily lining of the cupola, and by an equal distribution of blast increases the melting capacity, while, at the same time, it is easy on the lining of the cupola. The inside air chamber is said to be durable and without danger of iron entering the tuyeres.



The economical claims made for this cupola is, that it will melt faster and with less fuel than the ordinary style, it being stated that it saves one-third in time and one-fifth in fuel.

We understand that the Barnard & Leas Mfg. Co., of Moline, Ill., have one of these cupolas in successful operation.

Pittsburg Foundrymen's Association.

The Pittsburg Foundrymen's Association met in the rooms of the Builders' Exchange, December 28, with President Robert Taylor in the chair.

The paper of the evening, read by A. B. Harrison, Ph. D., chemist of the Clinton Iron & Steel Co., was on "Freaks of Foundry Iron," in which the author illustrates with a systematic set of tables some of the capricious changes with which the founder is liable to meet.

The author concluded by relating some instances where foundries had been deceived by good looking but inferior coke, and blamed the iron for many faults, with which it was later proven to have no connection.

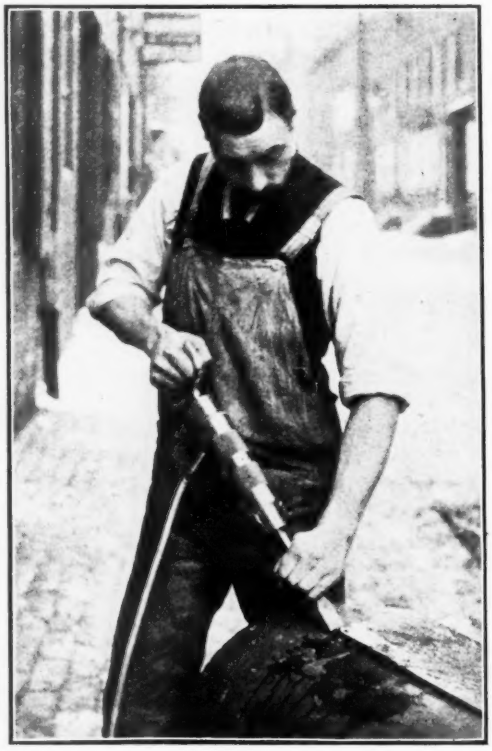
Owing to the statistical nature of the paper it was deemed wise to postpone discussion of the subject until the printed copy could be put in the hands of the members. This subject will therefore be reopened at the January meeting.

Wm. Beard is operating a new foundry at Abbeville, Ga.

Pneumatic Tools for the Foundry.

Among the remarkable developments of this remarkable age, that of the mechanical devices actuated by compressed air are the most interesting; and likely to work an entire revolution in certain industrial branches.

The most ingenious and remarkable of these appliances is, perhaps, the Valveless Pneumatic Impact Tool, manufactured by the Clement Pneumatic Tool Co., No. 123 So. 11th St., Philadelphia, Pa.

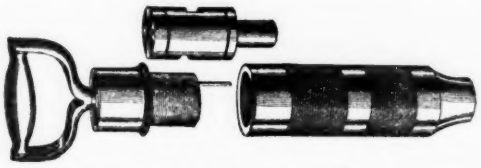


METHOD OF USING PNEUMATIC CHIPPER.

One of the striking features of this tool is its marvelous simplicity. What would the reader think of a tool consisting of but three parts, or pieces—a cylinder, a butt piece and a hammer—having no valves or springs of any kind in its make-up, striking twelve to sixteen thousand blows per minute, and doing the work of six to ten men per diem in a more perfect manner than can be done by the old methods; yet this is the construction, and what is done by this wonderful tool.

The tool is used for chipping castings and metals of all kinds, for caulking boilers, ships, tanks, etc., heading flues and driving rivets; it is also used for lettering and carving marble and granite for monumental and artistic achitectural purposes; which shows that the operator has perfect control over it.

In chipping castings, one man with a tool can do as much work as four, when chipping to a line or true surface; and the work will be done as well as if done on a planer. In rough foundry chipping, one man with a heavy tool can readily do as much work as eight or ten men by the old method of chipping by hand; but the quantity of work depends in a measure on the man holding the tool, for if the operator is one wedded to the old hand-method of doing things, the amount of work he will turn out will be, comparatively speaking, small. It is therefore desirable to place the tools in the hands of young men, who, as a rule, are ambitious and take pride in running a new machine.



COMPONENT PARTS OF TOOL.

When used for caulking boilers, tanks, etc., one man can caulk forty to sixty lineal feet per hour; and make a tighter and better joint than ever was made by hand methods.

From these facts evolve so simple a business proposition that competition in trade will compel the universal adoption of pneumatic tools in all possible lines of industry.

While these tools have been on the market but a comparatively short time they are already in use in some of the largest shipyards, such as Cramps, and in machinery and boiler shops, foundries, etc., both in the United States and Europe.

The tool being so extremely simple of construction, the life of it is almost indefinite; the manufacturers guaranteeing it against all repairs for two years.

The Friction Pulley Co., of Sandy Hill, N. Y., is building an addition to the machine shop, 104x40 feet, two stories, and a foundry addition 30x40 feet.

Fire Fiend.

A fire in the Juniata Iron Works at Pittsburg, Pa., did a damage of $15,000 on the 27th ult.

A small blaze took place at the plant of Sweet Car Wheel & Foundry Co. at Chelsea, Mass., December 12.

The Maloney Foundry, of Medina, N. Y., was visited by fire on December 11. Damage about $500, with insurance.

A slight blaze in the superintendent's office of the Builders' Iron Foundry, Providence, R. I., did a small damage on December 19.

Rubbish near the furnaces of the American Iron Works, at 515 Sixth street, San Francisco, Cal., caused a lively blaze on December 26. Damage, about $1,500; covered by insurance.

The office and pattern room of the St. Paul Foundry Co. at St. Paul, Minn., was damaged about $300 by fire on January 5. The cause of the fire is supposed to have been spontaneous combustion.

The foundry of the Condor Iron Co., 100 Condor street, East Boston, was gutted by a fire on January 2. The fire originated in the molding shop, a corrugated iron structure 200 feet by 65 feet, and destroyed all but the company's pattern shop.

The foundry of T. H. Colvin, at Providence, R. I., was damaged by an incendiary fire to the extent of $3,000 on December 24. About half of this loss falls on the Armington & Sims Engine Co. and the Providence Steam Engine Co., whose patterns were stored in Mr. Colvin's pattern shop.

A fire in East Boston January 2 destroyed the foundry plant of G. H. Gibby on Condor street, and practically destroyed the foundry and blacksmith plant of the Boston & Lockport Block Co. The loss will be fully $40,000. It is understood to be fully covered by insurance. The fire started in the foundry of G. H. Gibby, which is leased from the block company. Gibby had been doing a general casting business. The fire probably caught from a spark from the furnace. The fire extended to the foundry, blacksmithy and machine shop of the block company, and they are practically a total loss. The buildings destroyed were of no great value, but a large amount of machinery was destroyed with them, and Gibby's patterns also went up in smoke.

Notice.

Advertisements entitled Situations Wanted or Situations Vacant will be inserted in this column One Insertion FREE. All others, 25 cents per line.

FOR SALE—No. 3 Root blower, used only few months; to be replaced with largest size. Address box 4, care THE FOUNDRY PUBLISHING CO.

WANTED—By a foundryman, who thoroughly understands brass and iron founding and can furnish the best of references a position as foreman. Address Box 46, The Foundry.

WANTED—Position as superintendent or foreman of car foundry, understand making both wheels and castings; eight years with last firm; satisfactory references. Address Box 47, care The Foundry.

FOR SALE—The machine shops and foundry of the Maltby & Wallace Co. A fine opening for the right kind of a man. For particulars write to J. W. Stipes, Assignee, No. 39 N. Neil St., Champaign, Ill.

WANTED—Situation by a foundryman, who has had a large experience in all kinds of light and general foundry work. Is a pattern maker by trade, but has acted as general foundry foreman and superintendent for nearly fifteen years in a large works employing 600 men and casting about 60 tons daily. Best of references. Address, Box 45, The Foundry.

FOR SALE—A complete set of iron patterns for one of the most modern constructed corrugated warm air furnaces on the market including three sizes. Also a first-class set of register patterns. Furnace has been on the market five years and has good established trade which goes with patterns. Price reasonable. Reasons for selling, other business demands our capital and attention. Address, Box 48, The Foundry.

I like your journal and should be glad to see a similar one started here, where foundry procedure has not kept pace with the improvements in other branches of engineering.

FRANKLIN JACKSON,
Victoria Foundry,
Cardiff, Wales.

Among the Foundries.

Joseph Turcotte, of Oscoda, Mich., intends to erect a foundry.

Dobbie & Stuart will erect a new foundry at Niagara Falls, N. Y.

J. D. Smith has begun operations at his new foundry in Alamosa, Col.

The Coats Foundry of Visalia, Cal., will construct a new foundry building.

Mueller & Kapplemann have started a new foundry at Two Rivers, Mich.

H. O. Harney & Co., of Union, N. Y., will add an extension to their foundry.

The Bridgeford Foundry Company, of Louisville, Ky., will erect a new plant.

Lee & Shumway have started a foundry and machine shop in Wyalusing, N. Y.

The Blacklock Foundry Company will enlarge their plant at South Pittsburg, Tenn.

Z. W. Hood & Son will build and operate foundry and machine shops at Harmony Grove, Ga.

Horace Staples, of Westport, Conn., has purchased the foundry hitherto operated by E. & A. Nash.

Lancaster, N. Y., will have a new foundry erected by Frank Goss, George Young and Henry Caldwell.

The Attalla Foundry & Machine Co., of Birmingham, Ala., will occupy the Shahan Foundry building.

A. S. Cooper retired January 1st from the Shette Machine and Foundry Co., of New Cumberland, Ohio.

The Federal Hill Foundry Company, of Baltimore, Md., Patrick Kennedy proprietor, will erect a new plant.

Messrs. Bierce & Walker have organized a stock company to carry on a foundry business at Winona, Minn.

Herr & Ronian have leased the foundry at Lock Haven, Pa., and are prepared to do all kinds of foundry work.

The Brunswick (Me.) Manufacturing Company are erecting a new foundry which they expect to occupy by February 1st.

Harry Guenther & Bro., of Owensboro, Ky., will establish a branch foundry and machine shop at San Antonio, Texas.

J. W. Penney, founder and machinist, Mechanics Falls, Me., will erect an addition to his plant in the early part of the year.

The brass foundry at the corner of Allen, Charles and Brighton streets, Boston, Mass., has been purchased by Geo. H. Lane.

Aaron Pearson has purchased the foundry at St. Peter, Minn, formerly owned by T. Maurseth and operated by G. A. Sjoyren.

J. W. Penney & Sons, Mechanics Falls, Me., have made an extensive addition to their shop. They make a specialty of bronze work.

Hinckley & Egery Iron Co., of Bangor, Me., have completed an addition to their foundry, and equipped it with modern appliances.

The iron foundry of the late Edwin Josselyn, of Lawrence, Mass., has been purchased by Mr. Wm. R. Hart, of Lowell, Mass.

The Terrace City Brass and Iron Foundry, at Yonkers, N. Y., has been purchased by Allen & Irwine, who will conduct the business on an enlarged scale in the future.

The Hamilton (O.) Machine and Foundry Company has closed a contract for the erection of a brick building one story high and 119x40 feet in length, to be used as a foundry.

M. O'Rorke & Co., of Peoria, Ill., are preparing to make extensive improvements in their foundry. Before the end of the year they will enlarge it, almost doubling its capacity.

The Fulton Steam Boiler Works, at Hammond, Ind., have incorporated with a capital stock of $100,000. They will operate a foundry in addition to the other parts of the plant.

The Bielhen Foundry and Machine Co., of St. Joseph, Mo., is contemplating the removal of its plant to some point further east, where it will come in closer contact with its patrons.

The Penn Steel Casting Co., of Chester, Pa., after erecting a large new foundry, have installed in the chipping shop a 20-ton electric crane to replace the one formerly operated by steam.

The foundry plant of Wm. Yagle & Co., of Pittsburg, has undergone many improvements recently. The manufacture of ingot molds has been commenced, with capacity of about 20 tons per day.

The Kootenay Iron Works is looking for a location at Nelson, Wash., to erect a large foundry. Messrs. A. R. Burrow, Geo. W. Richardson and Geo. A. Bigelow, Spokane, Wash., are interested.

The Missouri Malleable Iron Co., of East St. Louis, has begun work on an addition to its annealing room and intends putting in additional ovens to increase its capacity one-third.

Charles A. Coleman has accepted a position as superintendent of the O. G. Thomas Foundry at Taunton, Mass. He was formerly superintendent of the New England Stove Co.

John Rice & Bro. Co., of Stevens Point, Wis., have made an addition to their foundry at the corner of Clark and First streets, that will nearly double the capacity of their works.

The Oleson Foundry and Machine Works, at Massillon, O., which were entirely destroyed by fire last June, have been replaced with fireproof structures and refitted with new and modern machinery.

Dobbie Foundry & Machinery Co., of Niagara Falls, N. Y., has been incorporated with a capital of $40,000. Directors—John Dobbie, A. J. Dobbie, Alexander J. Porter, A. R. Gow, and John T. Horton.

The Midland Steel Co., Muncie, Ind., is making improvements in its plant costing about $30,000, erecting a steel building, 80x300 feet, to contain additional furnaces and appliances, and also adding a 500 horse-power boiler.

The H. C. Bowen Foundry Co., of Providence, R. I., has been incorporated with a capital stock of $50,000. Incorporators, Henry C. Bowen, of this city; Seabury W. Bowen, of Fall River, and Elisha C. Mowry, of Providence, R. I.

One of the newest and most important enterprises established in Dillon, Mont., during the past year is the Cambrian Iron Works, David Davies manager. The works are equipped with all the latest machinery and a brass and iron foundry.

The Noble & Johnson Machine Co., of Hoosick Fall, N. Y., has been incorporated to manufacture paper mill machinery and such other lines as may be adopted. The company will erect complete shops, including an iron and brass foundry.

The Excelsior Brass Works, of Dubuque, Ia., will be removed to East Moline, Ill., where it will occupy the buildings left vacant by the defunct stamping works. It is expected that the shops will be in operation soon after the first of the year. About 100 men will be employed.

A reorganization of the Sharpsville Foundry & Machine Co., at Sharpsville, Pa., has been perfected, and George W. Johnson and Thomas M. Eagan have purchased an interest and will conduct the business. The plant will be equipped with new machinery and resume operations at once.

Ferdinand S. Randall has purchased of Riker & Gerlach, 36 and 38 Mechanic street, Newark, N. J., the brass and metal foundry of that firm. The business will be known as the Empire Metal Works. Mr. Randall is well known in Chattanooga and New York. His New York office is 60 and 62 Liberty street.

The Slaymaker Barry Co., which is building a lock works at Connellsville, Pa., is preparing plans and receiving bids for the erection of an addition to the works in the shape of an iron foundry for the purpose of making all its castings, which it has hitherto bought in the market. The foundry will be of brick.

The W. M. Thompson Co. has been incorporated at Sioux City, Iowa, to operate a general foundry business. The corporation is permitted to commence business with a capital stock of $20,000. The officers of the company are: W. M. Thompson, president; M. H. Thompson, vice-president, and M. E. Thompson, secretary and treasurer.

The Lorain Foundry Co., of Lorain, O., began active operations January 1. Several orders of considerable magnitude have been booked, and the outlook is considered very encouraging for a busy year. This concern makes a specialty of sand and chilled rolls, ingot molds and heavy castings up to 75,000 pounds in weight. General foundry work and brass castings are also handled.

The Buckeye Malleable Iron and Coupler Company, Columbus, O., has just completed the enlargement of its plant by the addition of five new annealing ovens and the enlargement of four old ones, making the monthly

capacity 9,000 completed couplers. It has also erected a new office building which is a model in its way, containing all the necessary accessories, including a completely equipped laboratory.

The old Lynn foundry, of Lynn, Mass., will be opened by the Co-operative Foundry Co., a corporation organized under the Massachusetts laws. The new company will do a general business in iron, brass and composition castings, and will give employment to 150 hands. The works are now undergoing a thorough supervision and many repairs and alterations are under way. The officers of the company are: President, Albert J. Maddock; treasurer, James A. Murphy, Boston.

The Whitin Machine Works, at Whitinsville, Mass., has made many improvements about their plant during the year, among which are several in the foundry department. Two new cupolas have been put in, and work in fine shape. Coke is being used in them instead of coal, as formerly. Another feature is a new tramway. By means of that large ladles filled with iron are carried to all sections of the foundry. The molders secure their iron from these ladles, and do not have to carry their small ladles so far as formerly.

Theodore H. Colvin, of the Colvin Iron Foundry, Providence, R. I., who lately suffered from an extensive fire, is making preparations to remove his plant from West Exchange street to Globe street. Plans for new structures, which are to be larger and better adapted for the business, have already been prepared and submitted to the Inspector of Buildings for his approval. The new foundry building will be 177x102 feet and one story high. It will be build of iron from designs of Architect Sawtelle. Pattern and carpenter shops will also be erected. The new building for this branch of the business will be 48x115 feet and two stories high. Work on the construction will be begun immediately.

Brass and Its Manufacture.

In taking up the price list of the American Brass Manufacturers we see the different headings: "rolled" or "sheet brass," which is generally known as "common or high brass," "brazing," "spinning" and "spring brass," etc., with the different prices per pound of these different grades of metal. It is not always thoroughly understood, however, by one not a manufacturer, why these different prices are charged for these different grades of brass, or in what this difference consists, and to this end a few remarks on the composition of the different grades of brass may be interesting to those handling or dealing in this metal.

To begin with, the brass which is ordinarily sold, unless otherwise specified, is known as common or high brass, and is spoken of as "rolled" and "sheet" brass, and consists generally of about 58 per cent. of copper and 42 per cent. of zinc. Looking further down the list we see "brazing, spinning and spring brass" is worth one cent a pound more than common or high brass. This additional extra cent a pound is charged for the reason that this brass contains a little more copper than the high brass above referred to, the copper being the expensive part of the brass, and the price is generally directly in proportion to the amount of copper which enters into the composition of the metal, and this brass will generally contain about 60 per cent. of copper and 40 per cent. of zinc.

This proportion is also known as "Muntz metal," after the name of the inventor, and while his patents cover a greater range of proportions than the one specified above, it is generally taken to denote this kind of metal. The difference between "spring brass" and the other brasses consists principally in the amount of cold work which is put on the metal after it is finally annealed. The more work that is expended the stronger and harder the brass.

The next grade of brass is "extra quality" for brazing, spinning and a high class of spring brass. This is two cents a pound more than the common or high brass, and consists of about 62½ per cent. of copper to 37½ per cent. of zinc. The next, "low brass," is four cents a pound more than the common or high brass, and contains 66⅔ per cent. of copper to 33⅓ per cent. of zinc. Gilding brass, oreide and bronze are generally about seven cents a pound more than the common or high brass and contain anywhere from 70 per cent. to 90 per cent. of copper with the remainder zinc.

In giving these proportions, however, it must be borne in mind that no two authorities will exactly agree as to the proportions of zinc in any one given form of brass, for the reason that if a good quality of zinc is used, the same results are obtained by using more zinc and less copper, and consequently a cheaper mixture per pound than you can by using a poorer quality, for the reason that the impurities in the poor qualities of zinc detract materially from the finished product. In the higher grades of brass, such as "extra quality" and "low" brass, the very best grade of zinc that can be purchased should be used. The hardest test to which brass sheet can probably be subjected is that of spinning, and in order that brass shall spin easily and well, it has to be made from very pure copper and very pure zinc. Too much care cannot be taken in being careful to select only those metals which are as pure as can be obtained in the market.

It is not to be understood that the proportions referred to above are the only ones used for making the different grades of brass, for the reason that these are only about the mean of what is generally understood in the trade, and variations on both sides of the quantities here given will, upon investigation, be found to exist, as also the manner in which the metals are mixed. The great secret in making brass being to combine the copper and the zinc, and volatilize as small an amount of the zinc as is possible, and at the same time to secure a perfect alloy of the two metals. It is nothing unusual on the first melting in making brass from new metal, to lose from two to three per cent. of the zinc, as the temperature at which it melts is only about 415 degrees Centigrade, while copper does not melt until a temperature of 1054 degrees Centigrade has been obtained.

There is also a lot of brass made, and in fact the majority of it, by the addition of scrap brass to the crucible containing the copper, and as this gets to be practically very much a rule of thumb in the different foundries, it is a difficult matter to state just what the exact proportions of any one grade are, and in fact, they are liable to be varied from time to time. It should be stated here that the mill man who succeeds in keeping his proportions very nearly constant, is the one who will have success with his orders and carry on a flourishing mill, for the reason that his customers, when placing successive orders will have greater confidence in him than in others who do not furnish a brass so uniform, for they will receive a brass like what they have worked on their tools and in their machines, and this simple problem is one of the greatest conditions to be met with in the trade.

In all of these brasses a great number of mill men are using a small percentage of aluminum, as it makes the brass flow more freely and gives it additional fluidity, and also combines with the impurities in the zinc and brings them to the surface, thus enabling them to use a poorer grade of zinc than they would ordinarily use, and at the same time obtain stronger and tougher metal. Aluminum is used to a small extent in sheet brass, and to a very large extent in brass castings. In both cases, especially where scrap is being worked over, aluminum is of decided advantage; the proportions varying with the grade of zinc used, and according to the results desired. Too much aluminum will give a very strong, tough brass, which is not always desirable if much tool work is to be done on it, and until mixing the aluminum bronzes, the proportions do not exceed more than from one to two pounds to the ton of brass, equalling from ½ of 1 per cent. to 1 per cent. of aluminum to the ton of brass. This is only mentioned incidentally as one of the latest innovation in the manufacture of brass. Aluminum, however, should not be used in any brass which it is intended to dip, for the reason that it seems to have such an effect on the metal that it does not allow it to present the same surface when dipped as though it had not been used, but a complete discussion of the effect of aluminum combined with copper and zinc is a subject important enough in itself for a separate article.

In regard to the manufacture of brass, as previously stated, the great trouble is in successfully combining a very volatile metal, and one which is as readily oxidized as zinc, with copper having its fusion point so very much higher, and the proportions of a mixture which are found by analysis to vary extensively from those which were put in the crucible. The best way probably to make

brass where it is being manufactured from both new copper and zinc, is to put all of the copper in a crucible and melt it, covering it with charcoal so as to prevent oxidization, as well as to prevent the metal from absorbing the gases from the fuel. This is a point which does not always receive the proper amount of attention, for if a fuel is used which contains many gases, they will be absorbed by the metal, and the best fuel over which to melt copper is coke, then charcoal, oil and gas, about in the order named, but it is very hard to get good results with the ordinary coals, and in some cases impossible.

After the copper is melted and has assumed a very red and sluggish appearance, the zinc should be added. It is necessary, however, not to add the zinc too fast or the low temperature of the cold zinc going into the hot copper, will, as the founders term it, "set" the copper, which if done will cause an excessive loss of zinc, for the reason that the copper has then got to be raised to the proper temperature in order to melt it, and as the zinc is in the pot that much longer than it should be, more of it is volatilized than is really necessary. Before the zinc is added it should be thoroughly warmed in order to drive off all the moisture, for the reason that if it contains any moisture it will form steam in the copper and cause an explosion.

After all the zinc has been added, the mixture should be well stirred and allowed to remain on the fire until the whole mass has been raised to the proper temperature for pouring, which is denoted by the zinc burning in a blue flame on top of the pot. Just as soon as this blue flame starts to appear, the pot should be removed from the fire and the metal poured instantly. The melting point of brass is also different from that of copper. It is impossible to give any definite degree of heat which will melt brass, however, as this varies with the proportion of zinc used, and also with the quality of the zinc, and it ranges all the way from 1021 degrees Centigrade to 550 degrees Centigrade.

The larger proportion of copper that brass contains, the softer and more ductile is the metal, and by the addition of zinc the metal becomes more brittle and harder. Tin is sometimes used to give the brass additional strength, but of course as soon as this is added it makes a more expensive mixture. A bronze for fine work is often made by using 80 per cent. of copper, 17 per cent. of zinc and three per cent. of tin. The red color of copper fades gradually into a yellow and becomes golden yellow when about 40 per cent. of zinc has been introduced into the mixture. From this point an increase in the proportion of zinc to about 60 per cent. will produce a still lighter color until this amount has been reached, and if the zinc is increased above this amount it starts to assume a bluish white appearance, so one can tell how great a percentage of zinc a mixture contains by the color of it. This, of course, is a matter of experience, and can only be accurately told by long practice, and of course from what has been said above, it will be seen that as the color of the metal changes the strength and ductility also change.

The best brass in the world is made in the United States, for the reason that we have within our borders the very purest of copper, and also the very best zinc. Brass which is cast for the express purpose of being rolled into sheet is often poured between marble blocks which are separated to the thickness of the rolling ingot to be cast, the sides of these blocks being formed of ordinary molding sand. The surface of the marble is covered with a layer of sand which has been prepared for this purpose. From this point the metal is rolled into sheet, being annealed at successive stages, and also the surface gone over with wire brushes in order to remove all flaws and blisters which may have appeared, so that they will not be rolled into the surface of the metal, but will leave it sound and free from scale, and that when the metal is rolled to the thickness of ordinary thin sheet these places where the blisters and flaws have been may not show.—Aluminum World.

A workman who was knocked senseless by an electric shock at the foundry of the Anaconda Copper Mining Co., was resuscitated, after the usual expedients had failed, by removing his clothes, burying him in the foundry sand, except his mouth and nose, and thoroughly soaking the sand with a jet of water. The same experience strangely enough happened to the same man twice.—American Machinist.

Obituary.

Frank W. Brown, foreman of Megquier & Jones' foundry, died in South Portland, Me., January 9, aged 41 years.

Wm. L. White, formerly foreman of the Cleveland Foundry Co., Cleveland, O., was instantly killed by an explosion on December 31.

Daniel D. Denton, whose death was announced from Brooklyn, N. Y., December 15, founded one of the earliest foundries in Binghampton, N. Y.

Hon. J. M. Latta, who was prominently identified with a number of Michigan enterprises, died Saturday night at Goshen, Ind., aged 63 years. He was president of the Muskegon Machine and Foundry Co. and controlled large pine interests in northern Michigan.

H. W. Clark, founder of the Clark Foundry and Machine Co., died at his residence in Knoxville, Tenn., December 27, of pulmonary consumption, after a short illness. Wyman Clark, as he was known, was respected by all who knew him, and his death leaves a blank in the ranks of Knoxville's business men that will not be easily filled.

One of Batavia's (Ill.) highly esteemed citizens, David R. Sperry, died December 31, aged 72 years. He had been a resident of Batavia for 30 years, was a successful manufacturer, and the president of D. R. Sperry & Co.'s foundry. He was widely known all over Illinois as the father of "good roads" and in favor of convict labor. He leaves a comfortable estate, a wife and four children.

In the death of Joseph D. Weeks, at Pittsburg on December 26, the iron and steel industries lose one of their most prominent members. Mr. Weeks is best known, perhaps, as editor of the American Manufacturer, though his writings have extended in many directions from metallurgy on one hand to political and industrial questions on the other.

For about ten years previous to 1886 Mr. Weeks was associate editor of the Iron Age, but severed his connection with this journal upon consolidating the American Manufacturer and the Iron World. His services were widely sought as a statistician. In the census of 1880 he was appointed as expert for the coke industry, and accepted the same position in connection with the last census.

G. F. S. Zimmerman, Frederick, Md., died at his home in that place December 16, of paralysis. He was born June 29, 1826, at Creagerstown, Md. At first he was associated with his father in the milling business. About 1849 he located a foundry at Charlestown, Va., for making iron castings and manufacturing threshing machines. He is said to have been the first inventor of a separator for threshers—a device for separating the straw during the process of threshing. In 1854 he removed to St. Joseph, Mo., and started a foundry similar to the one in Charlestown, returning in 1858 to Frederick, Md. He had patented several important inventions.

Just as we are going to press the sad intelligence reaches us that Charles Truesdale passed away at Cincinnati, O., on the 14th inst.

Mr. Truesdale was born in 1827 in Trumbull county, Ohio, and served an apprenticeship in his father's foundry in Poland, Mahoning county, which foundry by the way is still in existence. In 1846, after working a short time in Pittsburg, he came to Cincinnati and entered the employment of W. & R. P. Reser, at that time the pioneer foundry of the west, and after working for them as a molder until 1856, he was given charge of the foundry in the capacity of foreman. A few years later he acquired an interest in the firm, which he retained until the time of his death. Being made general manager of the foundry department he realized that there was a growing demand for a better class of work than had yet been made and being of a very energetic nature, he made many innovations in the old way of doing things until it soon became an established fact that the work of Wm. Reser & Co. was second to none.

That Mr. Truesdale was of an original disposition and not only understood his business, but was ambitious to leave it better than he found it, is amply evidenced by the fact that he was the designer and inventor of several appliances to facilitate foundry work. The most important of these is known as the Truesdale cupola, which is in use in many of the largest shops in the country.

He was one of Cincinnati's most respected citizens and one of its pioneer Republicans, having with the aid of Solomon P. Chase and others formed that party amid a great deal of opposition and political bigotry found here in the late fifties. He left a record that will not soon be obliterated.

The Strength of Hydraulic Cylinders.

Mr. W. T. Harder in a communication to "Machinery," has the following to say on the above subject, which should prove of especial value in places where it is sought to secure the minimum of weight, such as in modern steamships, and where the cost of transportation is high:

The widely varying results in the discussion of the above subject suggest that for cylinders of this size and for such a heavy pressure, a considerable reduction in the weight might safely be made by employing the well-known Rodman process for casting ordnance.

By this process, the casting is cooled from the inside by circulating water through the core. The metal next to the core is cooled first, then the metal outside of that cools and contracts upon that already solidified.

What takes place and the conditions existing when the whole has cooled, may be more apparent by considering the body of the cylinder to be made up of many co-axial layers or rings which are contracted successively upon those inside of them. This leaves most of the metal in a state of initial stress; that near the bore being in compression and that near the outside in tension.

It will be seen that, in a casting made in this manner, any pressure from within must first be transmitted to, and overcome considerable of the resistance of the metal near the outside before that near the bore can be subjected to any tensile or bursting strain. In this way the outer parts are compelled to bear their share of the strain, whereas, in a thick casting made in the ordinary way, it is quite conceivable that the metal near the bore might be strained to its ultimate limit, while that near the outside is exerting very little resistance.

It is said that the first cannon cast in the United States was made at Hagerstown, Md.

Plaster Paris Casts.

In the foundry, in the pattern-making department, in the machine shop, sometimes even in the drawing room, a man has occasion to make a plaster of paris cast. The cast may not amount to much, or it may be rather important. Years ago it used to be common to see men tramping the streets with exaggerated trays filled with all kinds of plaster images mounted on their heads, men who in many instances could doubtless have told a good deal about how his stock in trade was cast. I can give only a little experience.

I wanted a rather fine plaster cast, not for ornamental purposes, but I wanted it to smooth up rather nicely, and I wanted the surface to be just pure plaster of paris. I tried just about a dozen casts to no purpose. Pretty smooth the casts looked, but upon smoothing them up the surface was full of blow holes. I mixed the plaster by adding water and stirred up rather vigorously, then poured the mold. The result was discouraging. Then I put water in the vessel and sifted in the plaster, letting it settle to the bottom, after which I mixed by rather gingerly stirring. The first cast was a good one for the purpose.

Lest someone shall say you can find all this in so and so, I hurry to admit that I have no doubt of it. It does not follow that I have not read it somewhere; only that I do not remember where and when.—Ex.

Ancient Metallurgy.

In the Anthropological section of the recent meeting in Liverpool of the British Association for the Advancement of Science some interesting notes bearing upon ancient metallurgy were contributed. Dr. J. H. Gladstone spoke upon "The Transition From Pure Copper to Bronze Made With Tin." He said that copper was worked by the Egyptians in the Sinaiatic peninsula from the fourth to the eighteenth dynasty, perhaps from 5000 to 3000 B. C. At that period tools were made of pure copper in Egypt and Syria, and by the Amorites in Palestine, often on the model of flints. The efforts to make copper hard underwent three stages. The first was to get the copper to contain a large amount of cuprous oxide. The second was to mix it with

arsenic and antimony. This was done by the Egyptians in the twelfth dynasty, and it was probably at first accidental, but one specimen had been found containing 3.9 per cent. of arsenic, and this was probably a deliberately made alloy. Thirdly, it was gradually found that tin was the best metal to harden copper, but it was not so commonly found. Tin mixed with copper does occur before the bronze age, but only to a very small extent, ½ to 1 per cent. Afterward, as tin was more commonly found and became less expensive, it was more largely used, and so the bronze age was reached. In many parts of Egypt bronze tools and implements were found, and one specimen contained 9 per cent. of tin. Prof. Flinders Petrie had found a bronze bar at Medum, in Egypt, in one of the small tombs belonging to the fourth or fifth dynasty. The brass of the early Israelitish period of the Bible was bronze. The immense amount of bronze used in ancient times, 5000 years ago, was astounding. The question as to where this large amount of tin was obtained is still unsolved. Prof. W. Ridgway read a paper on "The Starting Point of the Iron Age in Europe." He said that the origin of the iron age is one of the most important points in European archaeology. Scandinavia could not be its place of origin, for there the iron age began later than the Christian era. And it is admitted that the iron age came in per saltum in the Swiss lake dwellings, in Italy, Greece, France and Britain. Hellstadt, in Austria, was, in fact, the only place in Europe where articles of iron were found gradually replacing those of the same kind made in bronze. Near the Hellstadt cemetery lay one of the most famous iron mines of antiquity. It was from this Austrian center that the use of iron spread into Italy, Switzerland, Gaul, Spain, Greece and Eastern Germany, among tribes that were using bronze weapons and implements, and Tacitus was our authority on this point. In a discussion, Dr. Montelius pointed out that there were instances of the use of iron in Scandinavia, gradually superseding bronze, in the fifth or sixth century B. C. A. J. Evans said there is very early evidence of the use of iron in Syria, whence it spread to Greece, and the spread of iron in Britain was earlier than is generally supposed, as early, in fact, as the sixth century B. C., especially in Ireland.

The Secretary of War failed to secure a reduction in bids for steel castings through readvertisement and contracts have been given the original bidders at their original prices. The Bethlehem Iron Co. receives the contract for supplying ten sets of five-inch siege gun forgings at 27½ cents per pound, and ten sets of seven-inch howitzer forgings at the same figure. The Midvale Steel Co. is awarded the contract for supplying 20 sets of forgings for seven-inch mortars at 31 cents per pound, and 30 sets of forgings for 3.2 inch field guns at 32 cents per pound. No award was made in the case of the forgings for three and two-tenths-inch field mortars, where the lowest bid was 60 cents per pound.

Cast Iron vs. Steel Tired Wheels.

Mr. R. C. P. Sanderson, in an address delivered before the Southern and Southwestern Railway Club, made the following interesting announcement as to the relative cost of cast and steel tired wheels.

Now, as regards the running qualities of steel tired vs. chilled wheels, it is an indisputable fact that chilled wheels can be turned out equally true for much less cost. I have it on certain authority that it cost 31 cents to grind a pair of new 33-inch wheels, mounted on the axle, and for regrinding old wheels on the axle 28 cents per pair. And these wheels, when ground, are just as true as any pair of steel tired wheels ever turned out of a lathe.

Reference to the report of the Committee on Brake Shoe Tests shows that the friction and loss of metal, where soft steel shoes were used on steel tires, was far greater than when soft steel shoes were used on cast iron wheels. The inference is perfectly plain that on curves the rail wear from the flanges of steel tired wheels will be greater than from chilled iron wheels, making a harder pulling train and necessitating more frequent renewals of rails, which are expensive.

A really first-class chilled wheel, cast in contracting chills, can be produced from high-grade materials, including royalties, at a

Foundry cost of, each..... $4.60
Or say at a selling price of, each..... 5.00

For a pair of such.....$10.00
Add for cost of grinding true..... .21

Cost of wheels when mounted, exclusive of axle and cost of boring, per pair...$10.21

We do not seem to be able to buy a really first-class article in the way of a steel tired wheel for much under $50 each, although some that promise well are

Offered at (turned), each..... $40.00
Two such 80.00
Difference in favor of the ground cast wheels 69.79
For an 8-wheel car this is, per car.... 279.17
For a 12-wheel car, per car..... 418.74

A reputable firm of steel wheel makers guarantees their wheels (costing $50 each new) for 260,000 miles; the M. C. B. guarantee for chilled wheels under the same service is 60,000 miles.

The steel tired wheels will average 3½ turnings to make the 260,000 miles.

First cost of a pair of steel-tired wheels, say $80.00
Cost of three and one-half turnings, shop handling and machine work.... 5.25
Cost of three and one-half removals and replacements at 60 cents..... 2.10

Total $87.35
Deduct value of scrap, say 1,108 pounds at $8 and $10 ton of 2,240 pounds.... 4.94

Cost per pair of steel tired wheels for 260,000 miles $82.41

Exclusive of interest account, 260,000 miles represents about eight years and eight months' average service.

Assuming from the above that we would need to use four and one-third pair of chilled wheels to make 260,000 miles, we have

Cost of four and one-third pair of chilled wheels ground..... .....$43.91
Cost of four and one-third replacements at 60 cents..... ..... 2.60

Total $46.51
Value of scrap, say 3,020 pounds at $10 per ton of 2,240 pounds..... 22.41

Cost of chilled wheels to run 260,000 miles..... ....$24.10
Difference in favor of the chilled wheels per pair at the end of 260,000 miles, say 58.31

It seems proper to draw the conclusion that a really first-class 600-pound 33-inch chilled wheel, ground true, costing perhaps 30 to 50 cents more than an average wheel, bought on rigid test and guarantee, especially marked and reserved for passenger service, is good enough for ordinary railroading.

The total valuation of 15,957,614 long tons of iron ore produced in the United States in 1895, as reported by the various mines to the United States Geological Survey, was $18,219,-684, giving an average value at the mine of $1.14. Michigan's product was valued at $8,403,958, Minnesota's at $2,803,452, and Wisconsin's at $633,165, or a total valuation at mines of $11,840,575 for ore produced in the Lake Superior region. Up to 1885 a list of twenty mines would have included all mines in the country which had in any one year reached or approximated an output of 100,000 tons, while in 1895 forty-four mines exceeded this amount, and of these forty-four all but seven were in the Lake Superior region.

"Science at the Beginning of the Century," a handsomely illustrated article in the January Harper's, by Dr. Henry Smith Williams, exhibits in a striking way the immense strides that have been made during the last three generations in both pure and applied science. This paper will be followed later by others showing in greater detail the development of the more important branches of science.

Cassier's Magazine of Illustrated Engineering has in its January number the following articles:

"Power Transmission from Niagara Falls," with eleven illustrations of the pole line between Niagara Falls and Buffalo, the converters, underground conduits, etc. Orrin E. Dunlap.

"Copper Mining in the United States," with seven illustrations of typical mining scenes in the Lake Superior region. William P. Kibbee.